Consommation et Corporations Canada
Bibliothèque

Consumer and Corporate Affairs Canada
Library

Compusave Inc.

Attitude study on gaseous fuels

Canada

CCA-170 (4-82)

H-MON-19153;E;C
Lacourse

TL154
A X

DEPARTMENT OF CONSUMER & CORPORATE AFFAIRS
LIBRARY
JAN 26 1984
BIBLIOTHÈQUE
MINISTÈRE DE LA CONSOMMATION ET DES CORPORATIONS

ATTITUDE STUDY ON GASEOUS FUELS

prepared for:
Consumer and Corporate Affairs Canada

prepared by:

Compusave Inc.
120 Holland Avenue
Ottawa, Ontario
K1Y 0X7
613-725-2990

August, 1983

EXECUTIVE SUMMARY

HIGHLIGHTS

Vehicle Grant Program

While the Vehicle Grant Program may have important information benefits, the results of the survey indicate that the level of funding in the current program is not an effective means of inducing commercial vehicle operators to convert to alternate fuels. This is supported by the following evidence:

- 9.6% of converted respondents did not use government assistance in adopting an alternate fuel.
- government assistance was ranked as the least important advantage in converting by both the converted and non-converted respondents.
- government grants were not considered to be an important reason to convert more vehicles by respondents who replied "yes, definitely" they would convert more vehicles.
- for those converted respondents who replied "definitely no" to converting more vehicles, government grants was the overwhelming reason they would not do so.
- among converted respondents, satisfaction with government programs was generally positive; however, it was much less than for other aspects.
- among non-converted respondents, the single most important reason for not converting was the cost of conversion; in other words, the current level of funding is insufficient to overcome this obstacle.

Information

Technical information, especially information supplied by the government, plays a critical role in the market place. This is supported by the following evidence:

- converted respondents possess a great deal more information about propane than non-converted respondents.
- while government information rated only third highest (out of 9) as a source in first introducing respondents to alternate fuels, overall it had the highest rating in terms of making a final decision to convert; this inspite of the fact that government grants per se are not deemed important by those same people.
- converted respondents, even after having made a decision, still claim to be unsatisfied with the current level of technical information.
- non-converted respondents rank "not enough information" as second in their reasons for not converting.
- knowledge regarding CNG is very low across Canada for both converted and non-converted respondents, except in B.C. where the knowledge of CNG is outstanding; presumably because of the province's information and grants program.

Why Convert?

Both converted and non-converted groups agree on the criteria used in the decision to convert to an alternate fuel. Economics - primarily the cost of fuel - is the most important reason. This is supported by the following results.

- both groups rated fuel cost, maintenance, and engine life as the most important advantages in conversion.
- both groups perceive alternate fuels as the least expensive.
- most converted respondents are convinced that propane is the most efficient and provides superior performance.
- for those definitely planning to convert more vehicles, 89% said that fuel costs was the number one reason; this was followed by maintenance and engine life.
- "fuel economy" received the highest score on overall satisfaction, followed closely by performance.

Barriers to Conversion

While there are a number of reasons why non-converted operators are not willing to convert, the most important reasons are conversion costs, lack of information, and availability at stations. In general, there appears to be a concern among both groups about the level and quality of service available to propane owners. This is supported by the following:

- both converted and non-converted groups were unanimous in ranking the disadvantages of alternate fuels, namely availability at stations in first place, followed by conversion costs, qualified mechanics, and installation and repair standards; all elements of customer service.
- both groups were in agreement that propane stations were less than half as prevalent as gasoline stations.
- both groups recognized that CNG stations were generally "not available".

Safety

Media coverage of alternate fuel vehicles would seem to indicate a public concern for safety. Among commercial operators, however, safety does not appear to be an important issue. This is supported by:

- the majority of respondents know that crash tests show propane tanks are safer than gasoline tanks.
- the majority of converted respondents felt that propane was the safest fuel; while among the non-converted, propane beat out gasoline in safety 2 to 1.

- both groups were unanimous that safety was the second least important disadvantage in converting to an alternate fuel.

- among those who have definitely decided not to convert any more vehicles, safety was not once mentioned as a factor.

- non-converted respondents do not regard safety as an important factor in their decision to remain with conventional fuels.

REPORT SYNOPSIS

1.0 METHODOLOGY

Compusave Inc. was engaged by CCA to conduct a large-scale national survey on gaseous fuels, specifically propane and compressed natural gas. The objective of the Attitude Study on Gaseous Fuels was to "measure the awareness of propane and CNG as alternative fuels to gasoline among commercial vehicle operators, to identify their attitudes towards the fuels, and to measure their intention to convert". A national survey was developed to empirically determine the attitudes of those firms who had already converted to an alternative fuel as well as those firms who had not converted.

Prior to the national survey, Optima Applied Social Research Inc. conducted eight in-depth group interviews among commercial fleet managers. The impressions and information gathered at these sessions were used in developing the mail questionnaire. EMR also made available a computer printout of all commercial fleet vehicle companies who had converted to an alternate fuel and made use of the government grant.

Initially it was agreed by CCA and EMR that the final sample of 1,000 respondents should roughly approximate the actual distribution by province of firms who had converted to an alternate fuel.

The Canadian Dun and Bradstreet file of commercial companies was used to randomly select the sample for the non-converted fleet companies. Previous research conducted in the United States by Dun and Bradstreet was able to identify Standard Industrial Codes (SIC's) with a high probability that firms with those codes will operate commercial vehicles.

Prior to the national survey, a pre-test was carried out in the local Ottawa-Hull area. The objectives for this pre-test survey were twofold; firstly to analyse the response rate to be used on the national survey, and more importantly, to determine if firms could understand and respond properly to the proposed questionnaire. Changes resulting from the pretest as well as comments offered by EMR and CCA were incorporated into the final questionnaire.

As shown in Table 1, the response rate was higher than expected from the converted companies with a total of 543 returns. Of this group, 52 were companies who had converted, but had been sent non-converted questionnaires, termed Group 3 respondents.

The survey achieved its goal of obtaining 1,000 returns. The split between converted and non-converted, however, favours converted returns, this difference being explained almost wholly because of the Group 3 returns. Although provincial stratification of the sample is not exact, it is close enough to yield reliable results.

TABLE 1

RESPONSE RATES FOR VALID QUESTIONNAIRES

PROVINCE	CONVERTED* RETURNS	CONVERTED* SAMPLE	CONVERTED* PERCENT	NON-CONVERTED RETURNS	NON-CONVERTED SAMPLE	NON-CONVERTED PERCENT	TOTAL RETURNS	TOTAL SAMPLE	TOTAL PERCENT	% NOT ANALYZED
QUEBEC	64	50	128.00	51	50	102.00	115	100	115.00	4.00
ONTARIO	267	250	106.80	204	250	81.60	471	500	94.20	1.80
MANITOBA	30	25	120.00	24	25	96.00	54	50	108.00	4.00
SASK.	22	25	88.00	26	25	104.00	48	50	96.00	4.00
ALBERTA	74	75	98.67	65	75	86.67	139	150	92.67	4.67
B.C.	86	75	114.67	68	75	90.67	154	150	102.67	3.30
TOTAL	543	500	108.60	438	500	87.60	981	1000	98.10	2.90

* INCLUDES GROUP 3

2.0 RESULTS

2.1 Fleet Vehicles

In terms of fleet size, converted respondents closely resemble the distribution of number of vehicles per firm, in the EMR grant files. In effect, there is a preponderance of companies with 1 to 5 vehicles. The non-converted respondents, however, appear to have larger fleets and fewer firms in the category 1 to 5 vehicles.

In converted fleets, only 20% of actual vehicles are converted to propane and only 0.5% to CNG. The survey captured only 12 CNG companies.

Because of the very wide range in reported mileage for some types of vehicles and because of non-responses, average mileage figures do not appear to be very reliable.

2.2 Type of Commercial Operation

In terms of type of operation, it can be said that the converted and non-converted samples are drawn from the same commercial population, and that any differences are due to the structure and biases of the sampling lists from which respondents were drawn.

2.3 Propane Knowledge

While it is clear that the level of knowledge about propane is statistically higher for converted respondents, their knowledge about the source of propane is not very impressive. In fact, the majority indicated that it was a waste product which was normally "burned-off". In addition, most converted respondents did not know that very little pressure is required to liquify propane.

For converted respondents there is no significant difference in the number of correct answers among provinces. For non-converted, however, there is a general east to west trend in the level of knowledge concerning propane. It is interesting that Alberta and B.C., the most important gas producing provinces, have the highest general level of knowledge of propane.

2.4 CNG Knowledge

In general, the level of knowledge regarding CNG is very low. In addition, there is no statistical significant difference in knowledge between converted and non-converted respondents. Only on one question did converted respondents score significantly better. While the majority of respondents for both groups answered zero questions correctly, there are outstanding regional differences.

It would appear that in Quebec, Ontario, and Manitoba, CNG is almost totally unknown as a vehicle fuel with the modal answer being zero. Saskatchewan and Alberta average 3 correct answers while

B.C. respondents were outstanding; 59 percent of the converted group got 4 or more questions. This clearly shows that the B.C. government's information program on CNG and the special provincial grant for CNG vehicles has increased the awareness and knowledge in that province.

In general, the natural gas producing provinces have higher levels of knowledge, regardless of whether the firm has converted or not, than other areas of Canada.

2.5 Comparison of Propane, Gasoline, and GNC

The comparison of propane, gasoline, and CNG provides one of the most interesting and insightful questions asked of the respondents. It reveals basic differences in perception between converted and non-converted as well as underlying regional attitudes.

The cheapest fuel per litre is CNG. Most respondents, however, indicated that propane was the least expensive. It appears that most converted operators are really sold on their propane vehicles in terms of operating costs; the majority (58%) believing that propane is the cheapest fuel. Non-converted also felt that propane was cheapest (36%); although 35 percent of this group replied that they didn't know. In both groups, almost the same number (28% for converted and 26% for non-converted) picked the right answer - CNG.

Efficiency of various fuels in different engines is a difficult concept to measure, even for professionals. Regardless of the real efficiency, most converted respondents (41%) felt that propane was best. Most non-converted (38%) simply did not know. There does not appear to be an overwhelming trend in any single direction.

Media reports and the Optima study seem to indicate that safety of propane vehicles is an extremely important issue in the minds of non-converted vehicle operators. While this may be true for the public at large or a vocal minority of commercial operators, the majority of respondents - even non-converted respondents - do seem to feel that propane is unsafe.

As expected the majority of converted respondents (53%) feel that propane is the safest. For non-converted, the majority (52%) simply indicated that they did not know which fuel was safest. If a real perceptual bias existed against propane among this group one would expect to see a larger response for gasoline. In fact, propane (25%) beat out gasoline (13%) by almost 2 to 1 as the safer fuel among this group.

There is no uncertainty among either group regarding the availability of vehicle fuel at stations. Both converted (92%) and non-converted (87%) know that gasoline is the most available.

In terms of most abundant natural resource the pattern of response for the two groups is almost identical; both indicate that CNG is the most abundant (57%). There is, however, a very strong east to west

trend in respondents perception of the abundancy of CNG, ranging from 42% in Quebec to 84% in B.C.

Like efficiency, performance is difficult to measure. While most converted (46%) feel that propane has the best performance and the non-converted (45%) don't know, the answers are not really indicative of any trend.

The results of the analysis seem to indicate that in western Canada, there is a greater awareness and acceptability of CNG as a motor fuel. The trend is particularly strong in B.C. where the provincial government has introduced special information and incentive programs. This is in spite of the fact that only a handful of respondents have actually converted to propane.

2.6 Availability of Fuels at Stations

In addition to propane and gasoline, diesel fuel was also included as a control question to measure reliability. For diesel, the modal value selected by both groups was the same. It would appear that the perceived availability of diesel is the same, regardless of the type of fuel presently being used. This result lends credibility to the entire questionnaire because it shows that in areas not concerned with gaseous fuels, the perception of the two groups is similar. However, in areas of potential divergence, the results give a true reading of these differences.

For propane, there is a statistically significant but not terribly large difference between the two groups. The analysis shows that all respondents perceive propane stations to be less than half as prevalent as gasoline stations, with converted respondents believing that there are a few more stations than the non-converted group.

For CNG, the perceptions of the two groups are again almost identical. Both have identical modal and average scores. At the time of the study, there were only 7 CNG stations in Canada. It is not surprising, therefore, that respondents felt that CNG was "not at all available".

2.7 Price of Fuel

As indicated earlier, most respondents felt that propane is the cheapest fuel. There were considerable number, however, who did not know or who selected CNG as the cheapest.

Both groups perceived diesel fuel to be about 90% the price of gasoline. For propane fuel, converted respondents perceived propane to be 52% the price of gasoline, while the non-converted felt propane was 59% the price of gasoline.

There is also some significant regional variation, Quebecers perceive propane as substantially higher while respondents from Ontario and Alberta believe propane is lower. These trends could be accounted for by provincial road taxes (Quebec has the highest at 13.6¢/litre)

except for the fact that there is no road tax in Saskatchewan and the average value is high here as well.

When it came to knowing the actual price, there seems to be little relationship between perception and reality. As of February 23, 1983, propane was about 73 percent of gasoline. All respondent groups, were substantially lower than this actual selling price. It must be concluded that consumers believe that the relative price of propane is actually lower than it is. All respondents - non-converted included - overestimated the price differential.

Statistical analysis indicates that there is no significant difference in distribution between the converted and non-converted group for the price of CNG.

All provinces display a similar pattern except for Quebec which perceives CNG as marginally higher than the remaining provinces. This is probably due to the fact that Quebec is the only province under study to apply a road tax on CNG.

No national statistics are available on the pump prices from the seven CNG stations. A telephone survey, however, yielded an average price of 24.2 cents per litre. This would represent a difference of 59 percent from gasoline. If this figure is true, then all respondents have underestimated the cost of CNG, the same pattern as propane.

2.8 Financial Incentives

The vast majority of all respondents (82%) realized that they were eligible for a federal conversion grant, while at the same time a similar number (73%) did not know of the CNG grant program.

The most important finding is that converted respondents were able to score substantially higher than non-converted. On average, the converted group got 2.9 questions correct while the non converted group scored on 1.6 questions.

For government incentives, it can be concluded that conversion of a vehicle greatly enhances the respondents knowledge of available programs and financial benefits. While almost everyone knows of the federal propane conversion program, hardly anyone knows about the CNG grant.

2.9 Advantages of Alternate Fuels

Even though the two groups appear to differ in the intensity of their overall attitude, examination of specific factors indicates that both converted and non-converted respondents have very similar criteria in judging the importance of a vehicle fuel.

Fuel cost was by far the most important advantage in using propane: 86 percent of converted and 65 percent of non-converted gave it the highest rank. Again for both groups, maintenance and engine life

received the next highest ratings. (For non-converted, performance also seems to be very important).

Looking at those factors which are least important, the converted group (most of whom had already received a grant) ranked government assistance as the least important factor, i.e. it had the lowest score on rank 1 (44%) and the second highest score on rank 7 (7%). The same trend existed for the non-converted group which ranked government assistance very low.

In general it can be concluded that economic factors pertaining to the operation of the vehicle - fuel cost, maintenance, engine life and performance - are the most important advantages. The lack of importance of government grants is surprising and may have implications for future policies regarding incentive programs.

2.10 Disadvantages of Alternate Fuels

Again the most important finding is that the two groups are almost identical in selecting the criteria by which to judge the disadvantages of an alternate fuel.

Availability of fuel at stations is given the highest rank among disadvantages. This is followed closely by conversion costs, qualified mechanics, and installation and repair standards.

Both groups are also unanimous in the least important disadvantages - provincial regulations, safety, and range. The lack of concern for safety as a disadvantage, is surprising given the prominence of this issue in the media.

In general, there is a clear concern among all vehicle owners regarding the aspect of service and repair, especially availability of stations, conversion costs, qualified mechanics and standards. On the other hand, vehicle owners do not feel that provincial regulations, safety or vehicle range are real problems.

2.11 Converted - Planning to Convert More Vehicles

The majority of converted owners (64%) definitely plan to convert even more vehicles. A small percentage (8%) appear to be unhappy and definitely plan not to convert any more vehicles. Quebec and Saskatchewan appear least likely to convert.

For the "yes" group, the three most important factors in bringing vehicle owners to their decision, is fuel costs (89%) followed by maintenance and engine life. These responses correlate very highly with the advantages selected in Question 8.

It should also be noted, that while government grants do pull some positive response, they cannot be considered to be an important factor in getting current propane owners to convert more vehicles.

For the 40 "no" respondents this question appears to have triggered some resentment of a small number of respondents towards government programs. For all three ranks, government grants were given as the reason why owners were not going to convert more vehicles.

2.12 Converted - Information Sources

In terms of first introduction, friends (24%), fuel distributors (22%) and government information (16%) are the most important source.

For their final decision, respondents indicated that fuel distributors got the first rank (31%) followed closely by friends (28%). Both the second and third rank choices were dominated by government information.

Given the fact, that respondents universally indicated that government grant programs are not an important criteria in converting, it is surprising to discover their reliance on government as an information source. While friends and distributors are the primary information sources, it is clear that government provides necessary supporting data.

The regional distribution of the rank of information sources for respondents' final decision shows that government information scores higher more times than any other factor when analyzed by province.

2.13 Converted - Private Propane Vehicle

Of the 474 converted respondents who answered this question; 146 (30.8%) own a private vehicle which has been converted to an alternate fuel. It would appear that commercial owners are carrying the same economics into their private affairs.

2.14 Converted - Satisfaction

In general it can be said that vehicle owners are satisfied. Fuel economy ranks highest among the factors, followed closely by performance. The majority of respondents give these two criteria the rank of 1.

People are also generally satisfied with government programs. This factor did, however, receive substantially lower rating than fuel economy.

In terms of technical information, some people are satisfied, some are undecided, and some are unsatisfied. In fact, 34 percent of respondents were mildly or totally unsatisfied.

A regional breakdown for each of the four satisfaction criteria reveals the following important features:

- Quebec is not nearly as satisfied with fuel economy as the rest of the provinces. This may be due to the higher provincial taxes.

- Ontario is by far the most pleased with government programs. B.C. and Quebec are least satisfied.

- Quebec and Saskatchewan are very unsatisfied with the amount of technical information available.

The relationship between overall satisfaction and the decision to convert more vehicles was also examined. There is general trend for those people who are generally more satisfied to answer "yes" to conversion, and those people who are less satisfied to answer "no". There are, of course, many more satisfied and many more willing to convert than the reverse.

2.15 Non-Converted - Seriously Considered Converting

Of the non-converted respondents 43 percent have seriously considered adopting an alternate fuel.

2.16 Non-Converted - Source of Information

Of those 43 percent who have seriously considered converting their vehicles, fuel distributors and friends were the most influential sources of information in their deliberations. Government information and magazines tied for third place as source of data.

2.17 Non-Converted - Important Factors

The highest percentage score given any factor on rank 1 (or in fact any other rank) was conversion costs (32%), followed by not enough information (25%) and availability (18%).

Although the vast majority of respondents (including non-converted) know the propane grant program can be used to offset the cost of conversion, many must still regard it to be too small to be effective. Cost of conversion was, in fact, the most important single factor on all ranks.

When taken into association with the clear results that both converted and non-converted do not regard government programs as an important advantage, it can be concluded that the vehicle grant program at its current level of financial support may not be very effective in inducing commercial operators to convert to alternate fuels. What may be more important, however, is that the information package that accompanies the grant application may play a large role in promoting the final decision. The true effectiveness of the grant may be that it acts as an incentive for vehicle operators to acquire information and make a decision on its own merits. It appears that the economy of the fuel is the deciding factor.

The key role that information plays as a factor is shown by the fact that the second highest score in rank 1 and rank 3 is given to lack of information. As will be recalled from the results on the satisfaction of converted operators, many respondents are unsatisfied with the lack of information. Among non-converted respondents, availability of fuel at stations is also a very important negative factor.

2.18 Non-Converted - Private Propane Vehicle

Fewer than 5 percent of non-converted respondents own a private vehicle which uses propane or CNG. This is contrasted with the more than 30 percent for converted operators.

TECHNICAL REPORT

TABLE OF CONTENTS

1.0 METHODOLOGY

1.1 Introduction
1.2 Questionnaire Design
1.3 Sample Frame
1.4 Respondent Selection
1.5 Pre-test
1.6 Final Questionnaire
1.7 Mail Out
1.8 Response and Follow-up
1.9 Response Rate
1.10 Statistical Techniques

2.0 RESULTS

2.1 Question 1 - Fleet Vehicles
2.2 Question 2 - Type of Commercial Operation
2.3 Question 3 - Propane Knowledge
2.4 Question 4 - CNG Knowledge
2.5 Question 5 - Comparison of Propane, Gasoline, and GNC
2.6 Question 6 - Availability of Fuels at Stations
2.7 Question 7 - Price of Fuel
2.8 Question 8 - Financial Incentives
2.9 Question 9 - Advantages of Alternate Fuels
2.10 Question 10 - Disadvantages of Alternate Fuels
2.11 Question 11 - (Converted) - Planning to Convert
2.12 Question 12 - (Converted) - Information Sources
2.13 Question 13 - (Converted) - Private Propane Vehicle
2.14 Question 14 - (Converted) - Satisfaction
2.15 Question 11 - (Non-Converted) - Seriously Considered Converting
2.16 Question 12 - (Non-Converted) - Source of Information
2.17 Question 13 - (Non-Converted) - Important Factors
2.18 Question 14 - (Non-Converted) - Private Propane Vehicle

Appendices

Appendix A: Interim Report, May 6, 1983
Appendix B: Initial Questionnaire and Correspondence
Appendix C: Approved Questionnaires
Appendix D: Compusave covering letter
Appendix E: Respondent comments
Appendix F: Road and Sales Tax

1.0 METHODOLOGY

1.1 Introduction

Compusave Inc. has been engaged by CCA to conduct a large-scale national survey on gaseous fuels, specifically propane and compressed natural gas. This project included establishing parameters for the sample frame and the in-depth analysis of the responses, as well as the actual conducting of the survey. As stated in the request for proposal, the objective of the Attitude Study on Gaseous Fuels is to "measure the awareness of propane and CNG as alternative fuels to gasoline among commercial vehicle operators, to identify their attitudes towards the fuels, and to measure their intention to convert". To succeed in carrying out this objective, a national survey was developed to empirically determine the attitudes of those firms who had already converted to an alternative fuel as well as those firms who had not converted.

1.2 Questionnaire Design

Prior to the national survey, Optima Applied Social Research Inc. conducted eight in-depth group interviews among commercial fleet managers. The impressions and information gathered at these sessions were used in developing a self applied questionnaire. Information from the Propane Gas Association of Canada (PGAC), as well as government guidelines, brochures, vehicle classifications, and prices of fuels were obtained from Energy, Mines and Resources. EMR also made available a computer printout of all commercial fleet vehicle companies who had converted to an alternate fuel and made use of the government grant. The total number of records on this file was 11,786 as of April 22, 1983.

1.3 Sample Frame

Initially it was agreed by CCA and EMR that the final sample should roughly approximate the actual distribution by province of firms who had converted to an alternate fuel.

Table 1 illustrates the final sample frame used to distribute a total of 6,000 questionnaires.[1] The figures on actual number of applicants was derived from EMR printouts of the Vehicle Grant Program.[2] As can be seen, the final sample does not always correspond to the provincial distribution of applications. The following reasons explain the anomalies:

Quebec. This province only had 3.4 percent of applicants but was assigned a sample of 100 or 10.0 percent. This is done because of the large size of the province and because of unique circumstances (i.e. language differences and provincial regulations which discourage use of propane).

---

1 In actual fact, 1,010 questionnaires were returned and processed.

2 The total of 10,565 applicants does not match with the actual computer tape of 11,721 applicants because of differences in dates.

Ontario. This sample has been reduced to only 50.0 percent from the 63.7 percent level. This size, however, is sufficient to measure any trends.

Manitoba and Saskatchewan. The sample sizes have been increased slightly to ensure an adequate representation.

Alberta. This sample is roughly equal to the provincial take-up rate.

British Columbia. The sample here has been increased in order to capture differences between propane and CNG in this province.

Some effort was also made to ensure a distribution according to type of applicant. Table 2 shows the national distribution of applicants by type of business operation. This will be compared later in the analysis with the actual distribution of respondents.

Some difficulties were encountered with the EMR file; for example, it was noted that a company may apply more than once for a grant and may be on the Vehicle Grant File many times. Certain taxi companies occur as many as seven times on the file. This situation detracts from the reliability of Table 2. Contractors (which are really installers) may make application on behalf of a client but may not have commercial vehicles themselves. For this reason, the national sample of converted users did not include applicants in the 04 category.

It was originally thought that the survey sample should be segmented by fleet size. Since no data exists to select the non-converted sample by fleet size, this idea was not pursued. It was also felt that the sample should reflect the geographic concentration of converted vehicle operators. However, since an analysis of postal codes of respondents showed that the distribution of applicants closely matched the distribution of population in selected categories, this selection criteria was also dropped.

An Interim Report (see Appendix A) delivered to CCA on May 6, 1983 outlined in detail the sampling frame.

Table 1

Correspondence between Conversion Grant Applications and Compusave Sample Set by Province

PROVINCE	APPLICATIONS		SAMPLE SET			
			Conversion (based on 25% response)	Non-Conversion (based on 12.5% response)	Final Project Sample	
	No.	%			No.	%
Quebec	357	3.4	200	400	100	10.0
Ontario	6,726	63.7	1,000	2,000	500	50.0
Manitoba	362	3.4	100	200	50	5.0
Saskatchewan	378	3.6	100	200	50	5.0
Alberta	1,634	15.5	300	600	150	15.0
British Columbia	1,056	10.0	300	600	150	15.0
Other*	52	.4	-	-	-	-
Total	10,565	100.0	2,000	4,000	1,000	100.0

* This number includes grant applications from the Maritimes, Yukon, and Northwest Territories which are not part of this project study.

Table 2

National Distribution of Applicants by Type

CODE	APPLICANT	NUMBER	PERCENT
00	Missing	57	0.48
01	Taxicab operation	1,078	9.15
02	Trucking	1,347	11.43
03	Manufacturing wholesale & retail	2,464	20.91
04	Contractor	1,397	11.85
05	Service industry	1,550	13.15
06	Sales, direct salesmen	900	7.64
07	Farmer, farm organization	1,142	9.69
08	Municipal or other government	475	4.03
09	Other	1,376	11.67
	Total	11,786	100

1.4 Respondent Selection

A number of respondent deletions were made on the EMR file. These included all commercial vehicle companies which had not yet received their government grant. Other groups that were deleted from the sample were those companies which were described as "installers"; those companies in the Atlantic provinces, the Northwest Territories and the Yukon; and those companies with non-viable or missing postal codes. Random sampling within the provinces according to the sample frame produced the necessary sample of 2,000 commercial companies.

The Canadian Dun and Bradstreet file of commercial companies was used to randomly select the sample for the non-converted fleet companies. Previous research conducted in the United States by Dun and Bradstreet was able to identify Standard Industrial Codes (SIC's) with a high probability that firms with those codes will operate commercial vehicles. This so called, TRINCS file, was used to select SIC codes in Canada. A list of those selected as well as the number of firms on the file are shown in Appendix A. This file was further refined by selecting only firms with five or more employees and firms which had a Dun and Bradstreet report within the last 18 months. From the total of 126,630 companies (23.8 percent of all companies on file) 4,000 were selected at random within the provinces.

1.5 Pre-test

Prior to the national survey, a pre-test was carried out in the local Ottawa-Hull area. Twenty-four companies were selected, on a random basis, for this survey. Of this number, half of the companies had converted vehicles and half had not. In addition, four companies in each category were French speaking. Each of these companies had been telephoned in advance of mailing out the questionnaire to introduce the program to them and assess their willingness to complete the questionnaire.

The objectives for this pre-test survey were twofold; firstly to analyse the response rate to be used on the national survey, and more importantly, to determine if firms could understand and respond properly to the proposed questionnaire. (See Appendix B).

Based on an overview of the returns received in the pre-test period, some necessary changes were initiated. Because of the lone response from Quebec[1] (even after follow-up calls were made) it was decided to adopt a Hull address for the term of this project to encourage more Quebec companies to return questionnaires.

---

1 One company in Ontario also answered in French.

1.6 Final Questionnaire

Consumer and Corporate Affairs received copies of this particular questionnaire in both English and French at this time and, along with Energy Mines and Resources were asked to analyse the questions and make comment. EMR reviewed this initial questionnaire, and provided lengthy comments (see Appendix B). Many changes which were adopted at this stage were based on the comments from EMR. After a meeting with Consumer and Corporate Affairs the questionnaires were approved and final authority for printing was given. The authorized questionnaires are included in Appendix C.

A total of four questionnaires were adopted for this survey:

- converted English
- converted French
- non-converted English
- non-converted French

The focus of the questionnaires separated at question 11 to more specifically analyse each of the two major groups - converted and non-converted.

After acceptance of the revised questionnaire by CCA, the questionnaires were printed with a numerical sequence in the top left corner. This numerical listing consisted of 4 digits as well as two blank boxes for additional coding on return of the questionnaire. The first box was used for the provincial code, numerals 1 through 6; and the second box was coded according to the company's conversion status (i.e. code 1 when the company was non-converted, code 2 when the company was converted, and code 3 when a non-converted questionnaire was mailed out to a company which had converted vehicles). This so called, Group 3, was a result of companies who had not used the government conversion grant and therefore were not on the conversion list even though they were in fact converted. The research design fully recognized this possible problem and provided for it in the statistics.

1.7 Mail Out

Mailing out of the 6,000 questionnaires was completed in the last week of May. Together with the questionnaire, each envelope included a covering letter from Compusave (see Appendix D) and a self addressed stamped return envelope. Addressing of the envelopes was carried out by computerized labels derived from the Dun & Bradstreet file. The converted sample was also mounted on computer to produce labels and select provincial samples.

Strict control was maintained throughout the mailing procedure to ensure that every company received a fully packaged envelope. Six hundred of these companies were situated in Quebec and received complete packages in French and a stamped return envelope to the address in Hull.

Table 3
Remedial and Follow-Up Measures

	Reminder Cards	Telephone Calls	2nd Questionnaire
Quebec	107	94	14
Ontario	646	111	121
Manitoba	69	-	12
Saskatchewan	68	-	11
Alberta	96	33	36
British Columbia	180	47	43
Total	1,166	285	237

1.8 Remedial and Follow Up Measures

Interestingly enough, questionnaires began returning before the mail out was completed. Until the middle of June, the number of returns on a daily basis was very high with an average of 65 per day. From June 15 to June 22, the returns fell dramatically indicating further action was necessary. On a daily basis each return was logged and filed and the company name was stroked off the list when the questionnaire was returned.

Areas of concern at this time were:

- nationally low response rate from non-converted companies, and

- low response rate overall from Quebec and British Columbia.

During the week of June 24th, Compusave administered a follow-up program on these companies. A bilingual interviewer began to follow-up by telephone those non-converted companies who had not returned the questionnaire from the provinces of British Columbia, Alberta, Ontario and Quebec. This clerk completed 285 calls and rectified the return rate substantially. On a national level, reminder cards were drawn up and mailed out to 1,166 companies (See Appendix D). For converted companies, 377 cards were mailed out to 4 of the 6 provinces: - British Columbia, Quebec, Ontario and Alberta. For the non-converted sample, 829 cards were sent to all provinces with the exception of Quebec. Table 3 summarizes the remedial and follow-up measures. It should be noted that while the response rate was greatly augmented by reminders, the non-converted sample did not reach projected sample size of 500.

1.9 Response Rate

Table 4 presents the number of returned questionnaires for converted, non-converted, and Group 3 respondents as well as those that were returned but could not be analyzed. The 29 which could not be analyzed were returned blank, often with some expression of non-interest in participating. These blank questionnaires are not to be confused with the 170 pieces of mail which were returned as undelivered mail.

Table 5 provides the response rates for the various categories.

The response rate was higher than expected from the converted companies with a total of 543 returns. Of this group, 52 were companies who had converted, but had been sent non-converted questionnaires. As stated previously, this possibility had been recognized and was allotted for in the statistics. As can be seen in Table 5, 4 of the 6 provinces responded in excess of the sample expected. Only Saskatchewan (with 22 instead of the projected 25), and Alberta with (74 of the projected 75), fell short of the sample frame. On the non-converted sample, only Quebec and Saskatchewan achieved the numbers required in the sample frame. Ontario's response rate was the lowest at 81.6 percent. Given the very large

TABLE 4

NUMBER OF RETURNED QUESTIONNAIRES

PROVINCE	CONVERTED	CONVERTED GROUP 3*	TOTAL	NON-CONVERTED	CANNOT BE ANALYZED	TOTAL
QUEBEC	63	1	64	51	4	119
ONTARIO	234	33	267	204	9	480
MANITOBA	29	1	30	24	2	56
SASK.	21	1	22	26	2	50
ALBERTA	66	8	74	65	7	146
B.C.	78	8	86	68	5	159
TOTAL	491	52	543	438	29	1010

* GROUP 3 ARE THOSE RESPONDENTS WHO RECEIVED A NON-CONVERTED QUESTIONNAIRE BUT WHO HAD CONVERTED SOME VEHICLES

TABLE 5

RESPONSE RATES FOR VALID QUESTIONNAIRES

PROVINCE	CONVERTED* RETURNS	CONVERTED* SAMPLE	CONVERTED* PERCENT	NON-CONVERTED RETURNS	NON-CONVERTED SAMPLE	NON-CONVERTED PERCENT	TOTAL RETURNS	TOTAL SAMPLE	TOTAL PERCENT	% NOT ANALYZED
QUEBEC	64	50	128.00	51	50	102.00	115	100	115.00	4.00
ONTARIO	267	250	106.80	204	250	81.60	471	500	94.20	1.80
MANITOBA	30	25	120.00	24	25	96.00	54	50	108.00	4.00
SASK.	22	25	88.00	26	25	104.00	48	50	96.00	4.00
ALBERTA	74	75	98.67	65	75	86.67	139	150	92.67	4.67
B.C.	86	75	114.67	68	75	90.67	154	150	102.67	3.30
TOTAL	543	500	108.60	438	500	87.60	981	1000	98.10	2.90

* INCLUDES GROUP 3

size of Ontario's sample, however, this rate does not effect the final results. The total number of non-converted questionnaires received was 438. If one could add Group 3 to this category (i.e. converted companies who were sent non-converted questionnaires) then the response rate would be 98 percent instead of 87.6 percent.

In summary, the survey achieved its goal of obtaining 1,000 returns. The split between converted and non-converted, however, favours converted returns, this difference being explained almost wholly because of the Group 3 returns. Although provincial stratification of the sample is not exact, it is close enough to yield reliable results.

A number of respondents chose to provide written comments on their return. These comments were not analyzed, but are included in Appendix E as a matter of interest.

1.10 Statistical Techniques

Mail surveys are notorius for their low response rates. The fact that rates of 24.6 percent for converted and 12.3 percent for non-converted were close to the predicted returns, was only attained by vigorous follow-up measures.

In order to raise the response rates, a conscious attempt was made to reduce the response burden. This was done by making the questionnaire short and the questions varied in their type of response. While both the converted and non-converted questionnaires appeared short in terms of physical size, there were 181 variables recorded from the returns. This in turn produced calculated variables, (such as number of correct answers, etc.) raising total analyzed variables to 215.

There was no opportunity for open ended responses. Variety, however, was provided in the structure of the questions:

- information check off (Questions 2, 5, 12, and 13)
- true/false (Questions 3, 4, and 8)
- seven point scale (Questions 6, 9, 10, and 14)
- ratio scale (Question 7)
- ranking (Questions 11 and 12)

As Kirlinger[1] points out ..."fixed alternative items have the decided advantages of achieving greater uniformity of measurement and then greater reliability, of forcing the respondent to answer in a way that fits the response categories previously set up, and of being easily coded".

---

1 Kerlinger, Fred N. Foundation of Behavioral Research. Holt, Rinehart & Winston, 1964, p. 470.

The use of the seven point scale (as opposed to a 10, 5, or 3 point scale) to determine attitude has received considerable attention in psychometric literature. However, the outstanding researcher in this field concludes:

> We are left, therefore, without being able to set up any hard and fast rule concerning the number of scale divisions to use. The optimal number is a matter for empirical determination in any situation. Fortunately, there is a wide range of variation in refinement around the optimal point in which reliability changes very little. It can be said, however, that the number 7 recommended by Symonds is usually lower than optimal and it may pay in some favorable situations to use up to 25 scale divisions.[1]

It has generally been found that smaller numbers of scale choices, (i.e. 5 or 3) do not discrimate well when there are many factors to be judged. On the other hand, more than seven choices tends to confuse respondents.

A word concerning the type of data collected must be made. According to the theory of data, there are four levels (or scales) of data: nominal, ordinal, interval and ratio. Nominal data simply denotes a category, with the numeric values having no real meaning. Such is the case with data such as male-female or true-false. In ordinal data, values are ranked in some fashion. Here the numeric values may convey some statistical but limited meaning. For example, the median is used as the measure of central tendency as opposed to the mean. For interval and ratio data, the value of the data has significance in itself and is subject to normal arithmetic methods (i.e. values are infinitely divisable).

Most of the data collected in the present questionnaire must be categorized as nominal (e.g. true/false, type of operation) or ordinal (ranking of attributes). As such the statistical tests applied to measures of association -typically called correlation - must be nonparametric.

The statistical test selected to analyze the questionnaire data is the one recommended by Siegel - the Contingency Coefficient (C).

> The contingency coefficient C is a measure of the extent of association or relation between two sets of attributes. It is uniquely useful when we have only categorical (nominal scale) information about one or both sets of these attributes.[2]

---

1 Guilford, J.P. Psychometric Methods. Toronto: McGraw-Hill, 1954, p. 291.

2 Siegel, S. Nonparametric Statistics. Toronto: McGraw-Hill, 1956, p. 196.

Such is the case of the major dependent variable in the current research design, namely converted and non-converted. (Some parametric statistics, Pearson's r^2, is used for a limited number of variables).

High significant values of C mean that there is a close association between variables. In the case of the analysis of converted and non-converted respondents, it is often the object to support a hypothesis by having a low, non-significant value of C; meaning that there is no association between the groups. Significance has been determined using a chi-square test at the 1% level.

There are two inherent drawbacks to using C:

1. Two contingency coefficients are not comparable unless they are yielded by contingency tables of the same size.

2. The contingency coefficient is not directly comparable to any other measure of correlation, e.g. the Pearson r, the Spearman r_s or Kendal τ .

This means that comparing the value of C in one analysis to another C in another analysis can be misleading, and that comparing the value of C (say .39) to the value of r^2 (say .92) cannot be done.

2.0 RESULTS

The results and analysis of each question will be undertaken in the order in which questions appear. Where appropriate the analysis will compare the major dependent variables:

- converted/non-converted
- province

2.1 Question 1 - Fleet Vehicles

This is a very complicated question because it is possible for non-converted respondents to have both conventional and alternate fuel vehicles and for all respondents to have a wide range of vehicle types and sizes, especially if they are a vehicle leasing company.

Table 6 presents the total number of respondents according to the number of vehicles they have in each size category by type of vehicle. Some respondents (25 or 2.5%) did not provide information on the number of vehicles. This was due in many cases to the fact that respondents owned vehicles which were larger (i.e. over 25,000 GVW) than the categories specified. Some completed the questionnaire except for the number of vehicles, perhaps believing that it could be checked against other records such as the vehicle grant program.

Examining the final percentages in Table 6, reveal that over 50 percent of respondents had small fleets of 1 to 5 vehicles. This is slightly smaller than the EMR figure of 68 percent in the vehicle grant program. It would appear therefore that respondents answering the questionnaire tended to have larger fleets than the general EMR file. The problem, however, is that the EMR file contains multiple entries for a single firm. Some taxi applicants have applied as many as seven times for one vehicle each time. The distribution of the remaining class sizes compares favourably with EMRs list.

Table 7 contains the number of respondents with propane or CNG by fleet size. As can be seen 55 percent of the total sample of respondents (which includes converted and Group 3) had at least one converted vehicle. It should be noted that, in the case of converted responses nearly 40 percent of the total were in the category 1 to 5 vehicles. This means that the converted respondents were generally much smaller in fleet size than the non-converted. In fact 72 percent of all converted (this compares favourably to 68% in the EMR file) had small fleets, whereas only 24 percent of non-converted had small fleets.

Table 8, provides data on the total number of vehicles with either propane or CNG for converted fleets. Of the total of 17,227 vehicles only 20.2 percent are propane and only 0.5 percent are CNG. The study failed to obtain a large number of CNG respondents. In fact there was only 1 in Quebec, 2 in Ontario, 2 in Saskatchewan, 1 in Alberta and 6 in B.C.; the ones in B.C. being very small fleets.

TABLE 6

TOTAL NUMBER OF RESPONDENTS BY FLEET SIZE

NO. OF VEHICLES	AUTOS	PERCENT	BUSES	PERCENT	VANS < 8500	PERCENT	VANS > 8500	PERCENT	TRUCKS < 8500	PERCENT	TRUCKS > 8500	PERCENT	TOTAL	PERCENT
0	458	46.65	862	87.86	577	58.84	882	89.89	530	54.03	647	65.96	25	2.53
1-5	382	38.96	34	3.45	299	30.48	83	8.46	343	34.96	244	24.87	495	50.44
6-10	55	5.61	16	1.73	52	5.3	5	0.51	44	4.49	39	3.99	157	15.95
11-20	29	2.96	21	2.12	23	2.29	4	0.41	35	3.57	23	2.39	112	11.43
21-30	13	1.33	13	1.33	12	1.19	3	0.31	7	0.71	9	0.93	55	5.60
31-40	10	1.02	13	1.33	5	0.51	0	0.00	4	0.41	4	0.40	37	3.77
41-50	5	0.51	5	0.51	1	0.10	0	0.00	5	0.51	5	0.53	18	1.83
51-60	5	0.51	3	0.31	1	0.10	0	0.00	0	0.00	0	0.00	12	1.22
61-70	0	0.00	4	0.41	1	0.10	0	0.00	5	0.51	1	0.13	7	0.71
71-80	1	0.10	3	0.31	1	0.10	1	0.13	0	0.00	0	0.00	13	1.32
81+	23	2.39	7	0.66	9	0.93	3	0.31	8	0.82	8	0.80	51	5.18
TOTAL	981	100.04	981	100.00	981	100.00	981	100.00	981	100.00	981	100.00	981	100.00

TABLE 7

TOTAL NUMBER OF RESPONDENTS WITH PROPANE OR CNG BY FLEET SIZE

NO. OF VEHICLES	AUTOS	PERCENT	BUSES	PERCENT	VANS < 8500	PERCENT	VANS > 8500	PERCENT	TRUCKS < 8500	PERCENT	TRUCKS > 8500	PERCENT	TOTAL	PERCENT
0	850	86.65	917	93.48	799	81.45	946	96.43	776	79.10	851	86.75	443	45.16
1-5	92	9.38	17	1.73	135	13.76	26	2.65	158	16.11	98	9.99	390	39.76
6-10	19	1.94	18	1.83	21	2.14	2	0.20	32	3.26	16	1.63	73	7.44
11-20	3	0.31	10	1.02	9	0.92	3	0.31	4	0.41	6	0.61	41	4.18
21-30	2	0.20	1	0.10	5	0.51	1	0.10	0	0.00	0	0.00	12	1.22
31-40	4	0.41	4	0.41	5	0.51	2	0.20	4	0.41	5	0.51	10	1.02
41-50	1	0.10	4	0.41	5	0.51	0	0.00	4	0.41	2	0.20	4	0.41
51-60	2	0.20	3	0.31	1	0.10	0	0.00	1	0.10	0	0.00	2	0.20
61-70	0	0.00	2	0.20	0	0.00	0	0.00	1	0.10	0	0.00	0	0.00
71-80	3	0.31	2	0.20	1	0.10	0	0.00	0	0.00	1	0.10	0	0.00
81+	5	0.51	3	0.31	0	0.00	1	0.10	1	0.10	2	0.20	6	0.61
														0.00
TOTAL	981	100.00	981	100.00	981	100.00	981	100.00	981	100.00	981	100.00	981	100.00

TABLE 8

NUMBER OF PROPANE AND CNG VEHICLES FOR CONVERTED FLEETS

	QUEBEC			ONTARIO			MANITOBA			SASKATCHEWAN		
	TOTAL	PROPANE	CNG	TOTAL	PROPANE	CNG	TOTAL	PROPANE	CNG	TOTAL	PROPANE	CNG
AUTO	278	11	7	3497	587	6	376	95	0	108	2	6
BUSES	12	0	0	2846	487	0	5	4	0	95	8	0
VANS <8500	437	30	1	1415	385	26	56	38	0	151	6	2
VANS >8500	362	11	0	223	80	0	25	19	0	5	2	0
TRUCKS <8500	54	31	0	1035	263	3	230	118	0	735	42	8
TRUCKS >8500	144	15	0	1306	325	7	66	47	0	166	7	0
TOTAL	1287	98	8	10322	2127	42	758	321	0	1260	67	16
% PROV. TOTAL		7.61	0.62		20.61	0.41		42.35	0		5.32	1.27

	ALBERTA			BRITISH COLUMBIA			ALL CONVERTED			PERCENT	PERCENT	PERCENT
	TOTAL	PROPANE	CNG	TOTAL	PROPANE	CNG	TOTAL	PROPANE	CNG	TOTAL	PROPANE	CNG
AUTO	821	17	2	190	91	14	5270	803	35	30.59	23.03	38.04
BUSES	338	146	0	199	93	0	3495	738	0	20.29	21.17	0.00
VANS <8500	268	85	10	117	52	0	244	596	39	1.42	17.10	42.39
VANS >8500	108	18	0	42	21	0	765	151	0	4.44	4.33	0.00
TRUCKS <8500	916	163	9	262	50	1	3232	667	21	18.76	19.13	22.83
TRUCKS >8500	256	112	0	83	25	0	2021	531	7	11.73	15.23	7.61
TOTAL	2707	541	21	893	332	15	17227	3486	92	100.00	100.00	100.00
% PROV. TOTAL		19.99	0.78		37.18	1.68		20.24	0.53			

Propane vehicles (except for vans greater than 8,500 GVW) are well represented in all types of vehicles. The distribution of propane vehicles actually approximates the distribution of all vehicle fairly closely. CNG vehicles are concentrated in autos (38%), vans less than 8,500 GVW (42%) and trucks less than 8,500 GVW (23%). However, the small number of total CNG vehicles (92) does not lend confidence to these numbers.

There is a wide variation in the ratio of propane vehicles to total vehicles (Saskatchewan 5% to Manitoba 42%).

Table 10 presents average mileage by vehicle type for converted and non-converted respondents. This data presents real problems. Firstly there is a tremendous variation in responses. As can be seen, the standard deviation is sometimes greater than the mean. Table 11 also shows that over 25 percent of respondents did not answer the mileage question. Another source of error is the distribution of respondents by type of operation. As will be seen in Table 13, only four non-converted bus operators answered the question. While this anomaly lies with problems in sample selection, four is hardly enough to establish a mean value. It was also noted that taxicabs had tremendously high mileages compared to the rest of the sample. These numbers also tended to skew the results.

Where respondents answered the mileage question in kilometers, values were converted to miles. When no indication as to unit was provided, it was assumed that the unit was miles. It is recommended that mileage figures not be used for further analysis.

Table 12 gives the percentage use (passenger, merchandise, both) for converted and non-converted by type of vehicle. Except for buses and vans over 8,500 GVW, there is no significant difference between the two groups. Discrepancy in buses is caused by the low responses in the non-converted group (i.e. 4 firms). For vans over 8,500 GVW, they represented only 4 percent of all converted vehicles and 2 percent of non-converted vehicles. It is apparent that the weight designation for vans was not a good choice.

2.2 Question 2 - Type of Commercial Operation

A minor coding problem was encountered with this question. Some respondents entered more than one category for their line of business. In the case of converted questionnaires, where a coding problem existed, the original EMR list was checked and the appropriate code entered. For non-converted responses, the Dun & Bradstreet SIC code was used as the deciding factor.

Table 13 presents a comparison between the distribution of converted and non-converted respondents by type of commercial operation. A Contingency Coefficient (C) value of .15 showed that there was a significant difference between the two distributions. This difference was most noteable in the "contractor" category and "bus transportation" category.

TABLE 9

NUMBER OF NON-CONVERTED VEHICLES

	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL	PERCENT
AUTO	516	3735	126	170	409	503	5457	35.71
BUSES	377	1817	6	25	6	69	2301	15.06
VANS <8500	1201	534	31	107	245	226	2345	15.34
VANS >8500	44	63	6	25	214	0	352	2.30
TRUCKS <8500	295	930	82	151	723	472	2653	17.36
TRUCKS >8500	654	490	82	182	428	340	2175	14.23
TOTAL	3087	7570	333	660	2024	1609	15284	100.00

TABLE 10

MEAN AND STANDARD DEVIATION FOR REPORTED MILEAGE

	CONVERTED	NON-CONVERTED	ALL RESPONDENTS	STANDARD DEVIATION
AUTO	34256	21889	28673	27693
BUSES	20475	31452	21829	22968
VANS <8500	29616	20884	26517	29374
VANS >8500	24554	28002	24873	22515
TRUCKS <8500	24823	20767	22493	15166
TRUCKS >8500	24103	25189	24457	19787

TABLE 11

RESPONSE RATE ON MILEAGE

	PERCENT
AUTO	73.81
BUSES	85.39
VANS <8500	77.27
VANS >8500	72.37
TRUCKS <8500	79.19
TRUCKS >8500	76.95
AVERAGE	74.44

TABLE 12

TYPE OF VEHICLE USE

	CONVERTED (PERCENT)			NON-CONVERTED		
	PASS	MERCH	BOTH	PASS	MERCH	BOTH
AUTO	81.09	10.95	7.96	80.00	8.46	11.54
BUSES	98.39	0.00	1.61	87.50	12.50	0.00
VANS <8500	19.67	69.95	10.38	17.57	74.32	8.11
VANS >8500	14.89	78.72	6.38	33.33	66.67	0.00
TRUCKS <8500	10.50	75.00	14.50	18.39	72.41	9.20
TRUCKS >8500	6.04	90.60	3.36	6.15	90.77	3.08
TOTAL	35.27	56.06	8.67	40.36	51.56	8.07

TABLE 13

TYPE OF COMMERCIAL OPERATION

TYPE OF OPERATION	TOTAL RESPONSES	TOTAL PERCENT	CONVERTED RESPONSES	CONVERTED PERCENT	NON-CONVERTED RESPONSES	NON-CONVERTED PERCENT
NO ANSWER	16	1.59	4	0.74	17	3.83
TAXICAB	52	5.30	38	7.00	4	0.96
TRUCKING	129	13.12	70	12.89	61	13.88
MANUFACTURER	147	14.97	78	14.36	73	16.75
CONTRACTOR	134	13.65	46	8.47	119	27.28
SERVICE	240	24.46	135	24.86	98	22.49
SALES	120	12.19	70	12.89	46	10.53
BUS TRANSPORTATION	98	9.94	67	12.34	17	3.83
FARM	47	4.77	35	6.45	2	0.46
TOTAL	981	100.00	543	100.00	438	100.00

It should be noted, however, that the "installer" or "contractor" category was removed from the EMR list in the respondent selection process. This was because "installers" could apply for a grant on behalf of someone converting but not necessarily owning a vehicle themselves. This is the reason that "contractor" responses for non-converted are almost 20 percent higher than for converted responses.

Many municipal agencies such as school boards and police departments have fleets of buses. These were picked up in the converted sample under the "bus transportation" category. On the other hand, the Dun & Bradstreet file deals mainly with commercial enterprises and under-reports municipal and government agencies. The very low response rate in "bus transportation" among non-converted respondents is explained by this difference. In addition Dun & Bradstreet does not cover the primary sector, including farms, very well. This is the likely reason for the difference in the farm category.

Of more importance, however, is the apparent "real" difference in taxicabs. This difference could reflect the fact that propane makes good economic sense to this particular sector, and therefore, has a preponderance of converted respondents. This hypothesis is diminished somewhat by the fact that the Dun & Bradstreet file primarily contains taxicab companies while most converted taxicab respondents appear to be individual vehicle owners who are under contract to a major firm. There may, in fact, be a "numbers" problem, i.e. many individual drivers who own their own vehicle but work for a relatively small number of firms.

The difference between the four groups for "trucking, manufacturer, service and sales" categories is not significant and appear to be drawn from the same population of commercial operators. These four groups account for 65 percent of all responses.

In general, it can be said that the converted and non-converted samples are drawn from the same commercial population, and that any differences are due to the structure and biases of the sampling lists from which respondents were drawn.

Unfortunately, because of differences in categories between the final questionnaire and the EMR data files, it is not possible to adequately compare the original EMR list (see Appendix A) with the national survey.

2.3 Question 3 - Propane Knowledge

All of the "true" questions on propane knowledge were taken from federal government literature on propane conversion. All respondents who had converted their vehicles had received the literature from which questions were taken. All "false" questions were taken from statements recorded in the Optima in-depth sessions with fleet managers. The following repeats the statements for the benefit of the reader.

a) Propane is a by-product of refining crude oil into gasoline. **TRUE**
b) About 80 percent of Canada's propane is produced from natural gas. **TRUE**
c) Every gas well produces propane which would normally be "burned-off" as a waste product if it was not collected. **FALSE**
d) Propane requires a great deal of pressure to convert it from a gas to a liquid. **FALSE**
e) Crash tests show that propane tanks are safer than gasoline tanks. **TRUE**
f) Commercial vehicle conversion to propane costs upwards from $1,000 per vehicle. **TRUE**

If respondents were to only guess at the answers, one would expect to find that the questions would be correct 50 percent of the time. To combat against guessing, a third response category, "Don't know", was included.

Table 14 reports the answers for all respondents, while Table 15 and Table 16 report the answers for converted and non-converted respectively. Each question will be examined individually.

2.3.1 Question 3a) - By-product

In total, fewer than one-half of respondents (45%) knew that this statement was true. While the majority of converted respondents (51%) knew the correct answer, a surprisingly high proportion (31%) answered it wrong. For non-converted, knowledge levels are much lower; only 31 percent got it correct and a large proportion (43%), answered it wrong.

Significantly more non-converted (26%) than converted respondents (19%), admitted that they did not know the answer. This trend of not knowing the answer, is consistently strong among all knowledge questions for non-converted, and supports the hypothesis that converted fleet managers are more knowledgeable then non-converted managers.

2.3.2 Question 3b) - Natural Gas

While the majority of all people answered this question correctly, the converted respondents (58%) scored significantly higher than non-converted (42%).

TABLE 14

PROPANE KNOWLEDGE - ALL RESPONDENTS

QUESTION	TRUE	%	FALSE	%	DON'T KNOW	%
A	442	45.08	335	34.17	204	20.74
B	523	53.32	138	14.10	320	32.58
C	442	45.08	196	19.95	343	34.97
D	455	46.41	290	29.52	236	24.07
E	727	74.07	35	3.59	219	22.34
F	847	86.30	70	7.18	64	6.52

TABLE 15

PROPANE KNOWLEDGE - CONVERTED

QUESTION	TRUE	%	FALSE	%	DON'T KNOW	%
A	275	50.64	167	30.76	101	18.60
B	313	57.64	71	13.08	159	29.28
C	279	51.38	96	17.68	168	30.94
D	251	46.22	177	32.60	115	21.18
E	459	84.53	14	2.58	70	12.89
F	505	93.00	30	5.52	8	1.47

TABLE 16

PROPANE KNOWLEDGE - NON-CONVERTED

QUESTION	TRUE	%	FALSE	%	DON'T KNOW	%
A	134	30.62	189	43.06	115	26.32
B	184	42.11	73	16.75	180	41.15
C	126	28.71	113	25.84	199	45.45
D	205	46.89	94	21.53	138	31.58
E	205	46.89	27	6.22	205	46.89
F	302	68.90	50	11.48	86	19.62

2.3.3 Question 3c) - "Burned-Off"

Most respondents did not know that this statement was false. In fact, the majority of converted respondents (51%) indicated that this statement was true. On this question, non-converted respondents scored better (26% said false) than converted (18% said false). To their credit, both groups of respondents strongly indicated that they did not know. In fact, this question had the highest "Don't know" level for the converted group.

2.3.4 Question 3d) - Great Deal of Pressure

Although this statement was also false, both groups had about the same proportion of respondents (46%) who indicated that it was true. However, more converted (33%) knew that it was false, than non-converted (22%).

2.3.5 Question 3e) - Crash Tests

Initially this statement was thought to be "a give away"; after all, why would the statement be made if it wasn't true. Most converted respondents (85%) interpreted it this way and provided a correct answer. On the other hand, a very large proportion of non-converted (47%) indicated that they did not know. This percentage was the same as the people who did answer correctly.

2.3.6 Question 3f) - Conversion Costs

Many more converted respondents (93%) were aware of conversion costs than non-converted (69%). Because of the very high number of non-converted who scored this question correctly, it was probably too easy.

2.3.7 Overall Analysis

While it is clear that the level of knowledge about propane is statistically higher (C = .35) for converted respondents, their knowledge about the source of propane is not very impressive. In fact, the majority indicated that it was a waste product which was normally "burned-off". In addition, most converted respondents did not know that very little pressure is required to liquify propane. They do, however, appear to be aware of the superior safety of propane tanks.

The trend should be noted that non-converted respondents consistently answer "false" more times than the converted group. This may denote a general negative attitude to the questions.

2.3.8 Number of Correct Answers

Table 17 presents the number of correct answers by province for converted respondents, and Table 18 for non-converted respondents.

As can be seen in Table 17, the majority of converted respondents scored 4 questions correctly. The Contingency Coefficient (.29) indicates that there is no significant difference in the number of correct answers among provinces. Quebec, however, does not score as well as other provinces; it has the highest level of zero correct (5%) and averages only 3 correct questions. On the other end of the scale, Ontario and Alberta had more respondents who answered 5 or 6 questions correctly.

For non-converted, the majority of respondents answered only 2 questions correctly. In this case however, the C value of .36 indicate that there indeed is a regional bias in the number of correct answers. Quebec has significantly more zero responses (i.e. no correct answers) than all other provinces. Conversely, Alberta scores much better (38% of respondents had 4 or more correct questions) than all other provinces. For non-converted, there is a general east to west trend in the level of knowledge concerning propane. It is not surprising that Alberta and B.C., the most important gas producing provinces, have the highest general level of knowledge of propane.

2.4 Question 4 - CNG Knowledge

Similar to propane knowledge, all "true" CNG questions were derived from federal government literature. The lone "false" question was made up for the questionnaire. The following repeats the questions for the benefit of the reader:

a) Compressed natural gas (CNG) is the same kind of natural gas piped into homes and businesses. **TRUE**
b) Substantially more pressure is required to convert CNG into a liquid than is required to convert propane into a liquid. **TRUE**
c) In its pure state CNG is tasteless, odorless, colourless and non-toxic. **TRUE**
d) Because of sulphur impurities, CNG forms more sludge in engines than gasoline. **FALSE**
e) Unlike gasoline, explosive mixtures of fuel and air cannot develop a CNG closed refueling system. **TRUE**
f) Commercial vehicle conversion to CNG can cost between $1,600-$2,000 per vehicle. **TRUE**

TABLE 17

PROPANE KNOWLEDGE -CONVERTED BY PROVINCE
CORRECT ANSWERS

NUMBER	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL
0	3	5	0	0	1	0	2
1	4	8	3	0	5	2	22
2	14	37	4	5	9	16	85
3	28	79	10	3	21	21	162
4	11	89	12	12	26	35	185
5	4	45	1	2	9	12	73
6	0	4	0	0	3	0	7
TOTAL	64	267	30	22	74	86	543

PERCENT

0	4.688	1.873	0.00	0.00	1.35	0.00	0.37
1	6.25	2.996	10.00	0.00	6.76	2.33	4.05
2	21.88	13.86	13.33	22.73	12.16	18.60	15.65
3	43.75	29.59	33.33	13.64	28.38	24.42	29.83
4	17.19	33.33	40.00	54.55	35.14	40.70	34.07
5	6.25	16.85	3.33	9.09	12.16	13.95	13.44
6	0.00	1.50	0.00	0.00	4.05	0.00	1.29
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

3RN07 TABLE 18

PROPANE KNOWLEDGE - NON-CONVERTED BY PROVINCE
CORRECT ANSWERS

NUMBER	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL
0	11	27	6	2	6	5	57
1	10	22	1	7	4	8	52
2	9	62	9	7	6	22	115
3	11	44	4	9	24	13	105
4	7	39	3	0	22	15	86
5	3	10	1	1	1	5	21
6	0	0	0	0	2	0	2
TOTAL	51	204	24	26	65	68	438

PERCENT

0	21.57	13.24	25.00	7.69	9.23	7.35	13.01
1	19.61	10.78	4.17	26.92	6.15	11.76	11.87
2	17.65	30.39	37.50	26.92	9.23	32.35	26.26
3	21.57	21.57	16.67	34.62	36.92	19.12	23.97
4	13.73	19.12	12.50	0.00	33.85	22.06	19.63
5	5.88	4.90	4.17	3.85	1.54	7.35	4.79
6	0.00	0.00	0.00	0.00	3.08	0.00	0.46
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Tables 19, 20, and 21 report the results on CNG knowledge for all, converted and non-converted respondents respectively. The outstanding feature of all tables is that the majority of respondents - both converted and non-converted - indicate that they do not know the answers. This could be expected when only 12 respondents (1 in Quebec, 2 in Ontario, 2 in Saskatchewan, 1 in Alberta, and 6 in B.C.) were converted to CNG.

2.4.1 Question 4a) - Same Kind

There was no significant difference between the way converted and non-converted answered this question. This was the only CNG knowledge question which was answered correctly by the majority of people (54%).

2.4.2 Question 4b) - Substantial Pressure

This is the only question in which the converted group (43% true) scored significantly better than the non-converted group (29% true). It should be pointed out, however, that most respondents in both groups admitted that they did not know.

2.4.3 Question 4c) - Tasteless, Odorless, Colourless and Non-toxic

Both groups scored almost exactly the same.

2.4.4 Question 4d) - Sulphur Impurities

Again there was no significant difference between the groups, although the non-converted did tend to score slightly better.

2.4.5 Question 4e) - Closed Fueling System

Differences between the two groups were marginal.

2.4.6 Question 4f) - Conversion Cost

Differences between the two groups for "true" and "don't know" answers were marginal. However, more non-converted respondents did not believe the conversion cost figures.

2.4.7 Overall Analysis

In general, the level of knowledge regarding CNG is very low. In addition, there is no statistical significant difference ($C = .13$) in knowledge between converted and non-converted respondents. Only on one question did converted respondents score significantly better.

Again, the tendency for non-converted to answer "false" more often is evident in the CNG questions.

TABLE 19

CNG KNOWLEDGE - ALL RESPONDENTS

QUESTION	TRUE	%	FALSE	%	DON'T KNOW	%
A	532	54.19	81	8.26	368	37.55
B	380	38.75	76	7.72	525	53.53
C	397	40.48	174	17.71	410	41.81
D	33	3.33	427	43.54	521	53.13
E	308	31.42	86	8.79	587	59.79
F	367	37.42	42	4.26	572	58.32

TABLE 20

CNG KNOWLEDGE - CONVERTED

QUESTION	TRUE	%	FALSE	%	DON'T KNOW	%
A	302	55.62	38	7.00	203	37.38
B	231	42.54	40	7.37	272	50.09
C	222	40.88	94	17.31	227	41.80
D	21	3.87	227	41.80	295	54.33
E	178	32.78	42	7.73	323	59.48
F	209	38.49	10	1.84	324	59.67

TABLE 21

CNG KNOWLEDGE - NON-CONVERTED

QUESTION	TRUE	%	FALSE	%	DON'T KNOW	%
A	220	50.24	50	11.48	166	37.80
B	126	28.71	38	8.61	272	62.20
C	172	39.23	82	18.66	182	41.63
D	8	1.91	210	47.85	218	49.76
E	122	27.75	50	11.48	264	60.29
F	151	34.45	46	10.53	239	54.55

2.4.8 Number of Correct Answers

Table 22 presents the number of correct answers by province for converted respondents, and for non-converted respondents (Table 23).

While the majority of respondents for both groups answered zero questions correctly, there are outstanding regional differences. For converted responses (C = .33) and non-converted (C = .42), the statistical tests showed that there was, indeed, a significant difference among provinces.

It would appear that in Quebec, Ontario, and Manitoba, CNG is almost totally unknown as a vehicle fuel with the modal answer being zero.

In Saskatchewan, both converted and non-converted averaged 3 correct answers.

In Alberta, the trend is not as clear. For converted, the mode is zero like the eastern provinces. The fact that 19 percent of converted Alberta respondents also scored 5 or 6 correct answers, tends to indicate that the large number of zero correct is an anomaly. This hypothesis is strengthened by the fact that non-converted in Alberta averaged 3 correct answers like those in Saskatchewan.

In B.C., converted respondents averaged 4 correct answers while non-converted averaged 3 correct. In fact, B.C. respondents were outstanding; 59 percent of the converted group got 4 or more questions. This clearly shows that the B.C. government's information program on CNG and the special provincial grant for CNG vehicles has increased the awareness and knowledge in that province.

In general, the natural gas producing provinces have higher levels of knowledge, regardless of whether the firm has converted or not, than other areas of Canada.

Another interesting aspect of Tables 22 and 23 should also be noted. In all provinces, the number of respondents getting 6 correct answers is much higher for CNG than for propane, even though the average score on all questions for CNG is much, much lower. This anomaly can possibly be explained by a phenomenum which has been observed by psychometricians on similiar tests where respondents, who do not know many answers have a higher tendency to guess. If this is the case random selection alone would give 3 correct answers. What appears to have happened is that most respondents truthfully answer the "Don't know" column, however, a small number become frustrated and begin to guess at the answer. By chance, of course, some will get all six correct.

TABLE 22

CNG KNOWLEDGE -CONVERTED BY PROVINCE
CORRECT ANSWERS

NUMBER	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL
0	16	74	12	3	20	8	133
1	8	41	6	2	5	4	66
2	10	34	6	1	10	8	69
3	7	41	2	7	12	15	84
4	14	34	1	5	13	18	85
5	7	27	2	3	7	17	63
6	2	16	1	1	7	16	43
TOTAL	64	267	30	22	74	86	543

PERCENT

0	25.00	27.72	40.00	13.64	27.03	9.30	24.49
1	12.50	15.36	20.00	9.09	6.76	4.65	12.15
2	15.63	12.73	20.00	4.55	13.51	9.30	12.71
3	10.94	15.36	6.67	31.82	16.22	17.44	15.47
4	21.88	12.73	3.33	22.73	17.57	20.93	15.65
5	10.94	10.11	6.67	13.64	9.46	19.77	11.60
6	3.13	5.99	3.33	4.55	9.46	18.60	7.92
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 23

CNG KNOWLEDGE - NON-CONVERTED BY PROVINCE
CORRECT ANSWERS

NUMBER	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL
0	16	62	9	5	9	7	108
1	9	25	7	3	4	0	48
2	7	34	4	4	4	15	68
3	11	22	0	8	15	20	76
4	6	42	3	3	22	13	89
5	2	15	1	3	2	8	31
6	0	4	0	0	9	5	18
TOTAL	51	204	24	26	65	68	438

PERCENT

0	31.37	30.39	37.50	19.23	13.85	10.29	24.66
1	17.65	12.25	29.17	11.54	6.15	0.00	10.96
2	13.73	16.67	16.67	15.38	6.15	22.06	15.53
3	21.57	10.78	0.00	30.77	23.08	29.41	17.35
4	11.76	20.59	12.50	11.54	33.85	19.12	20.32
5	3.92	7.35	4.17	11.54	3.08	11.76	7.08
6	0.00	1.96	0.00	0.00	13.85	7.35	4.11
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

While it is true that this practice tends to reduce the reliability of the question, the overall trends seem to be clear enough. In fact, any error introduced by guessing appears to be evenly dispersed through the provinces.

2.5 Question 5 - Comparison of Propane, Gasoline, and GNC

The comparison of propane, gasoline, and CNG provides one of the most interesting and insightful questions asked of the respondents. It reveals basic differences in perception between converted and non-converted (Table 24) as well as underlying regional attitudes (Table 25).

2.5.1 Question 5a - Cheapest

The cheapest fuel per litre is CNG. Most respondents, however, indicated that propane was the least expensive. It appears that most converted operators are really sold on their propane vehicles in terms of operating costs; the majority (58%) believing that propane is the cheapest fuel. Non-converted also felt that propane was cheapest (36%); although 35 percent of this group replied that they didn't know. In both groups, almost the same number (28% for converted and 26% for non-converted) picked the right answer - CNG.

2.5.2 Question 5b) - Most Efficient

Efficiency of various fuels in different engines is a difficult concept to measure, even for professionals. Regardless of the real efficiency, most converted respondents (41%) felt that propane was best. Most non-converted (38%) simply did not know. There does not appear to be an overwhelming trend in any single direction.

It is interesting to note, however, that more converted respondents (28%) felt that gasoline was the most efficient fuel, than did the non-converted (19%).

2.5.3 Question 5c) - Safest

Media reports and the Optima study seem to indicate that safety of propane vehicles is an extremely important issue in the minds of non-converted vehicle operators. While this may be true for the public at large or a vocal minority of commercial operators, the majority of respondents - even non-converted respondents - do seem to feel that propane is unsafe.

As expected the majority of converted respondents (53%) feel that propane is the safest. There may be some uncertainty, however, as 31 percent of this group admitted that they didn't know.

TABLE 24

COMPARISON OF PROPANE, GASOLINE, AND CNG

	NON-CONVERTED				CONVERTED			
	PROPANE	GAS	CNG	DON'T KNOW	PROPANE	GAS	CNG	DON'T KNOW
A-CHEAPEST	158	15	114	152	315	8	152	68
B-MOST EFFICIENT	126	84	59	168	222	150	49	122
C-SAFEST	107	57	44	230	286	43	43	171
D-MOST AVAILABLE	2	381	0	55	21	497	2	22
E-MOST ABUNDANT	53	34	248	103	107	27	310	99
F-PERFORMANCE	82	137	21	198	251	145	25	122
				PERCENT				
A-CHEAPEST	36.07	3.37	25.96	34.62	58.01	1.47	27.99	12.52
B-MOST EFFICIENT	28.85	19.23	13.46	38.46	40.88	27.62	9.02	22.47
C-SAFEST	24.52	12.98	10.10	52.40	52.67	7.92	7.92	31.49
D-MOST AVAILABLE	0.46	87.02	0.00	12.50	3.87	91.53	0.37	4.05
E-MOST ABUNDANT	12.02	7.69	56.73	23.56	19.71	4.97	57.09	18.23
F-PERFORMANCE	18.75	31.25	4.81	45.19	46.22	26.70	4.60	22.47

TABLE 25

COMPARISON OF PROPANE, GASOLINE, AND CNG BY PROVINCE - PERCENTAGE

	QUEBEC				ONTARIO				MANITOBA				SASKATCHEWAN				ALBERTA				BRITISH COLUMBIA			
	PROP	GAS	CNG	D.K.	PROP	GAS	CNG	D.K.	PROP	GAS	CNG	D.K.	PROP	GAS	CNG	D.K.	PROP	GAS	CNG	D.K.	PROP	GAS	CNG	D.K.
A-CHEAPEST	43.8	4.8	20.0	31.4	62.6	2.3	18.6	16.3	48.8	0	23.3	27.9	40.5	2.7	43.2	13.5	51.0	0	27.9	20.2	30.1	.9	57.5	10.6
B-EFFIC.	38.1	20.0	7.6	34.3	40.3	27.1	6.3	26.3	41.9	23.3	6.9	27.9	37.8	29.7	21.6	10.8	31.7	23.1	11.5	32.7	31.9	25.7	21.2	21.2
C-SAFEST	39.0	16.2	7.6	37.1	47.4	9.1	4.3	39.1	44.2	4.7	6.9	44.2	54.1	13.5	8.1	24.3	45.2	5.8	7.8	40.4	38.9	7.1	23.9	30.1
D-AVAILABLE	2.9	81.0	0	15.2	3.4	91.4	.6	4.6	0	88.4	0	11.6	5.4	89.2	0	5.4	.9	92.3	0	5.8	3.5	93.8	0	2.7
E-ABUNDANT	22.9	12.4	41.9	22.9	6.9	5.7	51.4	22.9	25.6	4.7	37.2	32.6	18.9	5.4	59.5	16.2	13.5	2.9	68.3	14.4	5.3	2.7	84.1	7.9
F-PERFORM.	41.0	17.1	4.8	37.1	42.3	26.3	3.1	28.3	39.5	23.3	4.7	32.6	32.4	40.5	8.1	18.9	36.5	30.8	2.9	28.8	28.3	38.1	9.7	23.9

For non-converted, the majority (52%) simply indicated that they did not know which fuel was safest. If a real perceptual bias existed against propane among this group one would expect to see a larger response for gasoline. In fact, propane (25%) beat out gasoline (13%) by almost 2 to 1 as the safer fuel among this group.

While it can be concluded that there is a great deal of uncertainty among both groups concerning which fuel may be the safest, there does not appear to be a predisposition against propane or CNG as a safe vehicle fuel.

2.5.4 Question 5d) - Most Available

There is no uncertainty among either group regarding the availability of vehicle fuel at stations. Both converted (92%) and non-converted (87%) know that gasoline is the most available. It is interesting to note that propane vehicle owners felt more strongly that gasoline was most available. Perhaps this reflects their actual experience in finding a propane station.

2.5.5 Question 5e) - Most Abundant

The pattern of response for the two groups is almost identical; both indicate that CNG is the most abundant (57%).

2.5.6 Question 5f) - Performance

Like efficiency, performance is difficult to measure. While most converted (46%) feel that propane has the best performance and the non-converted (45%) don't know, the answers are not really indicative of any trend. Most agree, however, that CNG is not really to be considered.

2.5.7 Regional Patterns

Table 25 presents the regional distribution of responses to Question 5. The following points highlight the regional analysis:

- statistically, there is no significant difference among provinces for efficiency, safety, availability and performance

- most respondents in Quebec (44%), Ontario (63%), Manitoba (49%) and Alberta (51%) indicated that propane was cheapest. On the other hand, in Saskatchewan (43%) and B.C. (58%), CNG was selected as the most economic fuel.[1]

---

1 In Saskatchewan propane was a close second (41%).

- there is a very strong east to west trend in respondents perception of the abundancy of CNG, ranging from 42% in Quebec to 84% in B.C.

The results of this analysis seem to indicate that in western Canada, there is a greater awareness and acceptability of CNG as a motor fuel. The trend is particularly strong in B.C. where the provincial government has introduced special information and incentive programs. This is in spite of the fact that only a handful of respondents have actually converted to propane.

2.6 Question 6 - Availability of Fuels at Stations

The previous question clearly established the fact that an overwhelming majority of respondents - both converted and non-converted -perceive gasoline to be most available at stations. Since it has been hypothesized in the literature that availability is a major factor in preventing more conversions, it is useful to determine how much less available these stations are perceived to be. Question 6 approaches this problem.

In addition to propane and gasoline, diesel fuel was also included as a control question to measure reliability. Not all respondents answered all parts of the question. Table 26 reports the response rate on fuel availability. As would be expected, converted respondents had a slightly higher response rate on propane than non-converted. Non-converted, however, were more apt to answer the other questions.

Table 27 reports the percentage results for converted and non-converted on the three fuels using a 7 point scale. On this scale, 1 is most available and 7 is least available.

For diesel, the modal value selected by both groups was the same - about 2. In statistical terms, the relationship between the two groups' responses is almost perfect. In fact, Table 28, which contains average availability scores, indicates very little difference between converted (2.4) and non-converted (2.5). It would appear that the perceived availability of diesel is the same, regardless of the type of fuel presently being used. This result lends credibility to the entire questionnaire because it shows that in areas not concerned with gaseous fuels, the perception of the two groups is similar. However, in areas of potential divergence, the results give a true reading of these differences.

For propane, there is a statistically significant but not terribly large difference between the two groups. For converted responses, the modal value is 5 and average score is 4.1, while for non-converted the modal value is 6 and average score is 4.6. This clearly shows, all respondents perceive propane stations to be less than half as prevalent as gasoline stations[1], with converted respondents believing that there are a few more stations than the non-converted group.

---

1 Mid-point on the scale is 4; both groups rated propane availability higher than the mid-point.

TABLE 26

RESPONSE RATE ON FUEL AVAILABILITY
(QUESTION 6)

	CONVERTED		NON-CONVERTED	
	NUMBER	PERCENT	NUMBER	PERCENT
DIESEL	498	91.71	407	92.82
PROPANE	522	96.13	396	90.43
CNG	445	81.95	375	85.65

TABLE 27

AVAILABILITY OF DIESEL, PROPANE AND CNG - PERCENTAGE

		1	2	3	4	5	6	7
DIESEL:	CONVERTED	25.10	28.31	26.71	13.05	5.62	1.20	0.00
	NONCONVERTED	23.20	28.87	24.74	17.01	5.67	0.52	0.00
PROPANE:	CONVERTED	5.36	5.94	18.97	27.39	27.59	13.98	0.77
	NONCONVERTED	4.23	3.70	8.99	23.28	25.40	30.69	3.70
CNG:	CONVERTED	0.22	0.22	0.22	2.02	3.60	35.96	57.75
	NONCONVERTED	0.00	0.00	0.56	5.59	7.26	27.93	58.66

For CNG, the perceptions of the two groups are again almost identical. Both have identical modal and average scores. Statistical tests also confirm that the distribution of responses is not significantly different. At the time of the study, there were only 7 CNG stations in Canada. It is not surprising, therefore, that respondents felt that CNG was "not at all available".

Looking at the average scores of availability in Table 28 there are a number of interesting regional trends. Except for B.C., all respondents appear to have about the same perception of diesel. The reason for the perceived lack of diesel stations in B.C. is not readily apparent from the questionnaire. The availability of propane is perceived to be highest in B.C. and least in Saskatchewan. Alberta, Manitoba, and Ontario all appear to have about the same rating. For CNG, there is almost no provincial variation, the only exception being B.C. where CNG is perceived to be slightly more available. After all, B.C. is the only province to have two CNG stations.

2.7 Question 7 - Price of Fuel

As indicated in Question 5, most respondents felt that propane is the cheapest fuel. There were considerable number, however, who did not know or who selected CNG as the cheapest.

Table 29 displays the price of diesel fuel relative to gasoline, for converted and non-converted respondents and by province. While the modal value for the converted group is slightly higher (100-91%) than the non-converted group (90-81%), the Contingency Coefficient indicates that the distributions are not significantly different. No significant regional variations could be detected.

Table 30 displays the price of propane fuel relative to gasoline, for converted and non-converted respondents and by province. In this instance, there was a significant statistical difference between converted and non-converted. For converted respondents, the modal value was 50-31 percent of gasoline and for non-converted it was 70-51 percent of gasoline. As shown in Table 31, there is a 7 percent difference in average relative price between converted (52%) and non-converted (59%).

There is also some significant regional variation, Quebecers perceive propane as substantially higher while respondents from Ontario and Alberta believe propane is lower. These trends could be accounted for by provincial road taxes (Quebec has the highest at 13.6¢/litre) except for the fact that there is no road tax in Saskatchewan and the average value is high here as well.

When it came to knowing the actual price, there seems to be little relationship between perception and reality. Table 32 provides the ratio between propane and gasoline prices in selected cities. As of February 23, 1983, propane was about 73 percent of gasoline. All respondent groups, however, were substantially lower than this actual figure. It must be concluded that consumers believe that the relative price of propane is actually lower than it is. All respondents - non-converted included - overestimated the price differential.

TABLE 28

AVERAGE AVAILABILITY SCORE BY PROVINCE
FOR CONVERTED/NON-CONVERTED

	DIESEL	PROPANE	CNG
QUEBEC	2.6	3.1	6.4
ONTARIO	2.7	4.3	6.4
MANITOBA	2.5	4.5	6.5
SASKATCHEWAN	3.1	5.9	6.4
ALBERTA	3.2	4.1	6.5
BRITISH COLUMBIA	4.2	3.7	6.2
CONVERTED	2.4	4.1	6.4
NON-CONVERTED	2.5	4.6	6.4

TABLE 29

RELATIVE PRICE OF DIESEL

DIESEL PRICE %	CONVER	NON-CONVER	QUE	ONT	MAN	SASK	ALTA	BC
			NUMBER					
120-111	6	1	1	5	0	0	1	0
110-101	41	4	2	37	0	0	2	4
100-91	127	33	11	83	9	7	13	37
90-81	123	36	16	64	10	12	32	25
80-71	48	28	7	21	7	9	18	14
70-51	11	8	2	9	1	0	5	2
50-31	5	3	1	4	1	1	1	0
30-0	4	1	2	2	0	0	1	0
TOTAL	365	114	42	225	28	29	73	82
DIESEL PRICE %			PERCENT					
120-111	1.64	0.88	2.38	2.22	0.00	0.00	1.37	0.00
110-101	11.23	3.51	4.76	16.44	0.00	0.00	2.74	4.88
100-91	34.79	28.95	26.19	36.89	32.14	24.14	17.81	45.12
90-81	33.70	31.58	38.10	28.44	35.71	41.38	43.84	30.49
80-71	13.15	24.56	16.67	9.33	25.00	31.03	24.66	17.07
70-51	3.01	7.02	4.76	4.00	3.57	0.00	6.85	2.44
50-31	1.37	2.63	2.38	1.78	3.57	3.45	1.37	0.00
30-0	1.10	0.88	4.76	0.89	0.00	0.00	1.37	0.00
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 30

RELATIVE PRICE OF PROPANE

PROPANE PRICE ¢	CONVER	NON-CONVER	QUE	ONT	MAN	SASK	ALTA	BC
			NUMBER					
120-111	2	1	0	2	0	0	0	1
110-101	0	1	0	0	0	1	0	0
100-91	1	2	1	0	1	0	0	1
90-81	5	3	5	2	0	0	1	0
80-71	51	25	22	24	3	12	5	10
70-51	193	46	15	98	21	16	32	57
50-31	229	28	12	157	8	2	51	27
30-0	14	5	8	8	0	0	1	2
TOTAL	495	111	63	291	33	31	90	98
PROPANE PRICE ¢			PERCENT					
120-111	0.40	0.90	0.00	0.69	0.00	0.00	0.00	1.02
110-101	0.00	0.90	0.00	0.00	0.00	3.23	0.00	0.00
100-91	0.20	1.80	1.59	0.00	3.03	0.00	0.00	1.02
90-81	1.01	2.70	7.94	0.69	0.00	0.00	1.11	0.00
80-71	10.30	22.52	34.92	8.25	9.09	38.71	5.56	10.20
70-51	38.99	41.44	23.81	33.68	63.64	51.61	35.56	58.16
50-31	46.26	25.23	19.05	53.95	24.24	6.45	56.67	27.55
30-0	2.83	4.50	12.70	2.75	0.00	0.00	1.11	2.04
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 31

AVERAGE RELATIVE PRICE

AVERAGE PRICE (%)	CONVERTED	NON-CONVERTED	QUEBEC	ONTARIO	MANITOBA	SASK	ALBERTA	B.C.
DIESEL	87.7	82.9	82.1	89.3	83.2	82.8	81.9	88.2
PROPANE	51.6	58.5	58.3	49.8	57.6	65.9	49.8	56.1
CNG	41.5	50.5	52.9	44.8	47.5	47.1	40.3	41.7

TABLE 32

POSTED PROPANE AND GASOLINE
PRICES IN SELECTED CANADIAN CITIES

CITY	PROPANE (CENTS/LITRE)	GAS	RATIO
VICTORIA	29.8	41.5	0.72
VANCOUVER	28.8	42.1	0.68
KAMLOOPS	28.4	42.0	0.68
EDMONTON	23.9	33.9	0.71
CALGARY	23.9	34.0	0.70
SASKATOON	27.7	34.3	0.81
REGINA	27.2	34.1	0.80
BRANDON	31.7	41.6	0.76
WINNIPEG	31.4	40.8	0.77
PETERBOROUGH	27.0	42.5	0.64
TORONTO	26.9	42.4	0.63
OTTAWA	28.4	43.1	0.66
MONTREAL	39.5	48.9	0.81
QUEBEC	39.5	49.4	0.80
AVERAGE	29.6	40.8	0.73

* SOURCE: EMR REPORT TE-82-10

Table 33 displays the price of CNG fuel relative to gasoline, for converted and non-converted respondents, and by province. Statistical analysis indicates that there is no significant difference in distribution between the converted and non-converted group, although the spread between the average price of 9 percent seems high. This is due, however, to three non-converted respondents who put the price of CNG higher than gasoline.

All provinces display a similar pattern except for Quebec which perceives CNG as marginally higher than the remaining provinces. This is probably due to the fact that Quebec is the only province under study to apply a road tax on CNG.

No national statistics are available on the pump prices from the seven CNG stations. A telephone survey, however, yielded an average price of 24.2 cents per litre. This would represent a difference of 59 percent from gasoline. If this figure is true, then all respondents have underestimated the cost of CNG. This is the same pattern as propane.

2.8 Question 8 - Financial Incentives

The problem with financial incentives is that they are not available in every province. The following Table 34 provides a summary of the regional distribution of incentives for purposes of this study. Appendix F contains a more detailed description of sales and road taxes by province.

Table 35 presents the raw results from Question 8. As can be seen the vast majority of all respondents (82%) realized that they were eligible for a federal conversion grant, while at the same time a similar number (73%) did not know of the CNG grant program.

Tables 36 and 37 present the number of correct answers by province for the two groups. The most important feature to note is that converted respondents were able to score substantially higher than non-converted. On average, the converted group got 2.9 questions correct while the non converted group scored on 1.6 questions.

No significant difference in the pattern of responses existed among the converted group. In the non-converted group, however, Saskatchewan scored significantly higher. There is no apparent reason why this should be.

For government incentives, it can be concluded that conversion of a vehicle greatly enhances the respondents knowledge of available programs and financial benefits. While almost everyone knows of the federal propane conversion program, hardly anyone knows about the CNG grant.

TABLE 33

RELATIVE PRICE OF CNG

CNG PRICE Z	CONVER	NON-CONVER	QUE	ONT	MAN	SASK	ALTA	BC
			NUMBER					
120-111	0	2	0	1	0	0	1	0
110-101	0	1	0	0	0	0	0	1
100-91	2	0	0	1	0	0	0	1
90-81	1	1	0	1	0	0	0	1
80-71	4	7	4	3	0	2	1	1
70-51	25	18	9	15	3	4	5	7
50-31	71	23	6	31	5	6	14	32
30-0	24	9	2	11	0	2	8	10
TOTAL	127	61	21	63	8	14	29	53
CNG PRICE Z			PERCENT					
120-111	0.00	3.28	0.00	1.59	0.00	0.00	3.45	0.00
110-101	0.00	1.64	0.00	0.00	0.00	0.00	0.00	1.89
100-91	1.57	0.00	0.00	1.59	0.00	0.00	0.00	1.89
90-81	0.79	1.64	0.00	1.59	0.00	0.00	0.00	1.89
80-71	3.15	11.48	19.05	4.76	0.00	14.29	3.45	1.89
70-51	19.69	29.51	42.86	23.81	37.50	28.57	17.24	13.21
50-31	55.91	37.70	28.57	49.21	62.50	42.86	48.28	60.38
30-0	18.90	14.75	9.52	17.46	0.00	14.29	27.59	18.87
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 34

Availability of Financial Incentives

	Incentive	Que.	Ont.	Man.	Sask.	Alta	B.C.
a)	federal grant on propane	yes	yes	yes	yes	yes	yes
b)	federal grant on CNG	yes	yes	yes	yes	yes	yes
c)	provincial grant on CNG	no	no	no	no	no	yes
d)	no road tax on propane	no	yes	no	yes	yes	yes
e)	no road tax in CNG	no	yes	yes	yes	yes	yes
f)	no sales tax on engines, etc.	no	yes	no	no	yes	yes

TABLE 33

KNOWLEDGE OF FINANCIAL INCENTIVES
ALL RESPONDENTS

FINANCIAL INCENTIVE	TRUE	FALSE	DON'T KNOW
FED. PROPANE	802	22	157
FED. CNG	229	39	713
PROV. CNG	120	111	750
NO TAX -PROP	562	117	302
NO TAX - CNG	209	61	711
NO SALES TAX	414	116	451

	PERCENT		
FED. PROPANE	81.75	2.24	16.00
FED. CNG	23.34	3.98	72.68
PROV. CNG	12.23	11.31	76.45
NO TAX -PROP	57.29	11.93	30.78
NO TAX - CNG	21.30	6.22	72.48
NO SALES TAX	42.20	11.82	45.97

TABLE 36

KNOWLEDGE OF FINANCIAL INCENTIVES
NUMBER CORRECT - CONVERTED

NUMBER CORRECT	NUMBER						
	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL
0	1	8	0	2	2	0	13
1	17	23	16	2	17	11	86
2	12	48	4	9	22	18	113
3	16	121	3	2	18	23	183
4	8	29	5	4	8	8	62
5	8	28	1	3	6	20	66
6	2	10	1	0	1	6	20
TOTAL	64	267	30	22	74	86	543

NUMBER CORRECT	PERCENT						
0	1.56	3.00	3.00	9.09	2.70	0.00	2.39
1	26.56	8.61	8.61	9.09	22.97	12.79	15.84
2	18.75	17.98	17.98	40.91	29.73	20.93	20.81
3	25.00	45.32	45.32	9.09	24.32	26.74	33.70
4	12.50	10.86	10.86	18.18	10.81	9.30	11.42
5	12.50	10.49	10.49	13.64	8.11	23.26	12.15
6	3.13	3.75	3.75	0.00	1.35	6.98	3.68
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 37

KNOWLEDGE OF FINANCIAL INCENTIVES
NUMBER CORRECT - NON-CONVERTED

NUMBER CORRECT	NUMBER						
	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL
0	24	64	16	7	19	24	154
1	16	29	6	3	20	8	82
2	6	39	1	12	13	18	89
3	2	44	0	3	3	5	57
4	1	6	0	1	8	1	17
5	2	22	1	0	2	7	34
6	0	0	0	0	0	5	5
TOTAL	51	204	24	26	65	68	438

NUMBER CORRECT	PERCENT						
0	47.06	31.37	31.37	26.92	29.23	35.29	35.16
1	31.37	14.22	14.22	11.54	30.77	11.76	18.72
2	11.76	19.12	19.12	46.15	20.00	26.47	20.32
3	3.92	21.57	21.57	11.54	4.62	7.35	13.01
4	1.96	2.94	2.94	3.85	12.31	1.47	3.88
5	3.92	10.78	10.78	0.00	3.08	10.29	7.76
6	0.00	0.00	0.00	0.00	0.00	7.35	1.14
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00

2.9 Question 9 - Advantages of Alternate Fuels

The two questions on advantages and disadvantages were not answered well. Although the response rates on these questions were acceptable (see Table 38), many respondents tended to check off all 1's or 7's, depending on their particular disposition. Some respondents obviously took a great deal of time and even wrote explanatory notes. Others, appeared to have tired and merely checked off a string of numbers. It is suggested here, that the number of factors - advantages and disadvantages - was too many for respondents to spend the appropriate amount of time on these questions.

Table 39 compares the responses for converted and non-converted on various advantages. The general trend is as one would expect; converted respondents rank advantages higher than the non-converted groups. This is supported by Table 40 which gives the average score of advantages by province. It would appear, therefore, that the converted group has a more positive attitude towards propane.

Even though the two groups appear to differ in the strength of their overall attitude, examination of specific factors indicates that both converted and non-converted respondents have very similar criteria in judging the importance of a vehicle fuel.

Fuel cost was by far the most important advantage in using propane; 86 percent of converted and 65 percent of non-converted gave it the highest rank. Again for both groups, maintenance and engine life received the next highest ratings. (For non-converted performance, also seems to be very important).

Looking at those factors which are least important, the converted group (most of whom had already received a grant) ranked government assistance as the least important factor, i.e. it had the lowest score on rank 1 (44%) and the second highest score on rank 7 (7%). The same trend existed for the non-converted group which ranked government assistance very low.

Other factors which do not appear important are pilferage (for converted and non-converted), safety (converted) and pollution (non-converted).

In general it can be concluded that economic factors pertaining to the operation of the vehicle - fuel cost, maintenance, engine life and performance - are the most important advantages. The lack of importance of government grants is surprising and may have implications for future policies regarding incentive programs.

2.10 Question 10 - Disadvantages of Alternate Fuels

Table 41 provides response rates for respondents on disadvantages. These rates, though still acceptable, are lower than the previous question; particularly for the converted group.

TABLE 38

RESPONSE RATES ON ADVANTAGES

	CONVERTED		NON-CONVERTED	
	NUMBER	%	NUMBER	%
A-FUEL COSTS	519	95.58	387	88.36
B-GOVN'T GRANT	516	95.03	379	86.53
C-MAINTENANCE	524	96.50	385	87.90
D-ENGINE LIFE	515	94.84	379	86.53
E-POLLUTION	515	94.84	381	86.99
F-OIL IMPORTS	505	93.00	368	84.02
G-SAFETY	508	93.55	345	78.77
H-PERFORMANCE	517	95.21	372	84.93
I-PILFERAGE	511	94.11	362	82.65

TABLE 39

ADVANTAGES OF PROPANE AND/OR CNG
PERCENT RESPONSE

CONVERTED

ADVANTAGES	VERY IMPORTANT 1	2	3	4	5	6	NOT IMPORTANT 7	
A-FEUL COSTS	85.74	7.13	2.70	2.89	0.39	0.00	1.16	100.00
B-GOVN'T GRANT	43.99	10.85	17.05	12.98	5.04	3.49	6.59	100.00
C-MAINTENANCE	62.79	12.79	11.83	8.59	1.91	0.76	1.34	100.00
D-ENGINE LIFE	61.55	14.76	10.10	9.32	1.94	1.36	0.97	100.00
E-POLLUTION	53.59	12.43	8.35	13.98	4.85	2.91	3.88	100.00
F-OIL IMPORTS	52.67	9.50	11.29	13.47	4.36	3.37	5.33	100.00
G-SAFETY	44.88	11.42	12.80	17.52	4.72	3.54	5.12	100.00
H-PERFORMANCE	50.29	14.51	12.77	16.25	3.68	1.16	1.35	100.00
I-PILFERAGE	45.01	9.00	12.33	13.70	4.50	5.48	9.98	100.00

NON-CONVERTED

ADVANTAGES	VERY IMPORTANT 1	2	3	4	5	6	NOT IMPORTANT 7	
A-FEUL COSTS	64.86	10.81	6.49	6.49	1.08	2.16	8.11	100.00
B-GOVN'T GRANT	35.91	7.18	13.26	16.02	4.97	4.42	18.23	100.00
C-MAINTENANCE	58.70	11.41	8.70	5.98	4.35	3.80	7.07	100.00
D-ENGINE LIFE	55.80	14.92	7.73	8.84	3.87	1.66	7.18	100.00
E-POLLUTION	32.42	16.48	10.99	15.38	6.04	6.04	12.64	100.00
F-OIL IMPORTS	39.77	17.05	10.80	9.09	5.11	5.68	12.50	100.00
G-SAFETY	41.21	13.33	12.12	9.70	8.48	2.42	12.73	100.00
H-PERFORMANCE	55.06	12.92	12.36	6.74	2.81	2.25	7.87	100.00
I-PILFERAGE	31.21	6.94	11.56	15.03	2.89	10.98	21.39	100.00

TABLE 40

AVERAGE SCORE OF ADVANTAGES BY PROVINCE
(PERCENT)

AVERAGE SCORE OF ADVANTAGES	CONVERTED						
	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL
1.1 TO 2.0	57.14	51.74	30.00	42.86	53.68	56.57	52.03
2.1 TO 3.0	33.33	30.89	50.00	23.81	28.42	27.27	30.86
3.1 TO 4.0	6.35	14.67	16.67	23.81	13.68	15.15	14.11
4.1 TO 5.0	3.17	2.32	3.33	9.52	2.11	1.01	2.47
5.1 TO 6.0	0.00	0.00	0.00	0.00	2.11	0.00	0.35
6.1 TO 7.0	0.00	0.39	0.00	0.00	0.00	0.00	0.18

AVERAGE SCORE OF ADVANTAGES	NON-CONVERTED						
1.1 TO 2.0	45.71	42.11	34.33	40.00	50.00	29.17	42.86
2.1 TO 3.0	28.57	28.95	27.27	13.33	21.43	37.50	27.51
3.1 TO 4.0	8.57	14.47	9.09	33.33	10.71	12.50	13.76
4.1 TO 5.0	5.71	5.26	9.09	6.67	3.57	16.67	6.88
5.1 TO 6.0	0.00	6.58	0.00	0.00	3.57	0.00	3.17
6.1 TO 7.0	11.43	2.63	0.00	6.67	10.71	4.17	5.82

TABLE 41

RESPONSE RATES FOR DISADVANTAGES

	CONVERTED		NON-CONVERTED	
	NUMBER	%	NUMBER	%
A-SAFETY	465	85.64	354	80.82
B-PRICE ?	472	86.92	356	81.28
C-AVAILABILITY	488	89.87	373	85.16
D-RANGE	476	87.66	369	84.25
E-TANK SIZE	485	89.32	367	83.79
F-PERFORMANCE	472	86.92	363	82.88
G-PROV.REGS.	462	85.08	350	79.91
H-CONVERSION $	481	88.58	363	82.88
I-MECHANICS	480	88.40	365	83.33
J-STANDARDS	472	86.92	365	83.33
K-INFORMATION	470	86.56	360	82.19

Table 42 compares the responses for converted and non-converted on various disadvantages. As expected, the general trend is opposite to the previous question on advantages. In this case, converted respondents rank disadvantages lower than the non-converted group (also see Table 43). The important aspect to note, however, is that the two groups are almost identical in selecting the criteria by which to judge the disadvantages of an alternate fuel.

Availability of fuel at stations is given the highest rank among disadvantages. This is followed closely by conversion costs, qualified mechanics, and installation and repair standards.

Both groups are also unanimous in the least important disadvantages - provincial regulations, safety, and range. The lack of concern for safety as a disadvantage, is surprising given the prominence of this issue in the media.

In general, there is a clear concern among all vehicle owners regarding the aspect of service and repair, especially availability of stations, conversion costs, qualified mechanics and standards. On the other hand, vehicle owners do not feel that provincial regulations, safety or vehicle range are real problems.

2.11 Question 11 - (Converted) - Planning to Convert

At Question 11, the study focusses separately on the two groups.

As shown in Table 44, the majority of converted owners (64%) definitely plan to convert even more vehicles. A small percentage (8%) appear to be unhappy and definitely plan not to convert any more vehicles. Quebec and Saskatchewan appear to have the least satisfied propane owners, i.e. least likely to convert.

For the "yes" group, Table 45 reports the three most important factors in bringing vehicle owners to their decision. Their overwhelming reason (89% on rank 1) is fuel costs. This is followed by maintenance and engine life. These responses correlate very highly with the advantages selected in Question 8.

It should also be noted, that while government grants do pull some positive response, they cannot be considered to be an important factor in getting current propane owners to convert more vehicles.

It should be noted that rank 2 has more responses than either rank 1 or 3. This occurred because 42 respondents gave all of their choices the rank of 1. In these cases, the average rank of 2 was given to all choices.

For the 40 "no" respondents, Table 46 presents the three most important factors in determining their decision. This question appears to have triggered some resentment of a small number of respondents towards government programs. For all three ranks, government grants were given as the reason why owners were not going to convert more vehicles.

The next most important factors are maintenance and performance.

10D29

TABLE 42

DISADVANTAGES OF PROPANE OR CNG

DISADVANTAGES	VERY IMPORTANT 1	2	3	CONVERTED 4	5	6	NOT IMPORTANT 7	
A-SAFETY	35.48	7.10	9.25	14.62	6.24	6.24	21.08	100.00
B-PRICE ?	35.81	10.17	15.68	17.16	6.14	4.45	10.59	100.00
C-AVAILABILITY	44.88	13.73	8.61	11.07	6.56	4.30	10.86	100.00
D-RANGE	24.79	8.19	12.82	12.82	9.45	8.82	23.11	100.00
E-TANK SIZE	35.05	10.10	11.75	11.75	6.60	8.25	16.49	100.00
F-PERFORMANCE	32.42	11.86	10.59	13.77	7.42	6.99	16.95	100.00
G-PROV.REGS.	22.94	5.41	8.87	16.88	8.23	9.52	28.14	100.00
H-CONVERSION $	43.45	13.72	12.68	13.93	3.53	2.91	9.77	100.00
I-MECHANICS	42.92	11.88	9.38	12.71	7.29	5.42	10.42	100.00
J-STANDARDS	43.43	10.81	10.81	12.50	6.99	5.30	10.17	100.00
K-INFORMATION	26.60	12.34	10.43	20.64	5.53	6.17	18.30	100.00

DISADVANTAGES	VERY IMPORTANT 1	2	3	NON-CONVERTED 4	5	6	NOT IMPORTANT 7	
A-SAFETY	40.83	10.65	9.47	17.16	3.55	4.14	14.20	100.00
B-PRICE ?	45.29	12.35	13.53	15.88	2.94	4.12	5.88	100.00
C-AVAILABILITY	66.85	16.29	5.06	3.37	1.12	0.56	6.74	100.00
D-RANGE	48.86	16.48	10.23	6.82	4.55	1.70	11.36	100.00
E-TANK SIZE	40.00	15.43	10.86	16.00	3.43	4.00	10.29	100.00
F-PERFORMANCE	46.24	15.03	12.72	12.72	2.89	2.89	7.51	100.00
G-PROV.REGS.	28.57	6.55	13.69	19.05	7.74	6.55	17.86	100.00
H-CONVERSION $	61.85	16.76	6.36	8.09	1.16	0.58	5.20	100.00
I-MECHANICS	56.32	17.82	8.05	6.32	1.72	1.72	8.05	100.00
J-STANDARDS	51.15	16.09	8.62	14.37	2.30	1.15	6.32	100.00
K-INFORMATION	49.42	14.53	8.72	15.70	2.33	0.58	8.72	100.00

TABLE 43

AVERAGE SCORE OF DISADVANTAGES BY PROVINCE
(PERCENT)

AVERAGE SCORE OF DISADVANTAGES	QUE	ONT	MAN	SASK	ALTA	BC	TOTAL
CONVERTED							
1.1 TO 2.0	34.48	31.95	10.00	12.50	22.39	19.28	26.20
2.1 TO 3.0	29.31	23.65	30.00	17.50	20.90	21.69	23.51
3.1 TO 4.0	17.24	17.43	36.67	10.00	23.88	20.48	19.27
4.1 TO 5.0	3.45	14.11	6.67	5.00	13.43	25.30	13.49
5.1 TO 6.0	12.07	9.54	16.67	0.00	19.40	10.84	10.98
6.1 TO 7.0	3.45	3.32	0.00	55.00	0.00	2.41	6.55
NON-CONVERTED							
1.1 TO 2.0	51.43	34.21	63.64	40.00	53.57	50.00	45.65
2.1 TO 3.0	25.71	34.21	27.27	33.33	25.00	29.17	30.98
3.1 TO 4.0	11.43	18.42	9.09	0.00	10.71	4.17	12.50
4.1 TO 5.0	2.86	9.21	0.00	6.67	3.57	16.67	7.61
5.1 TO 6.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.1 TO 7.0	8.57	1.32	0.00	0.00	7.14	0.00	3.26

TABLE 44

PLANNING TO CONVERT MORE VEHICLES

	YES, DEFINITELY	%	UNDECIDED	%	DEFINITELY NO	%
QUEBEC	28	45.90	23	37.70	10	16.39
ONTARIO	158	67.52	68	29.06	8	3.42
MANITOBA	19	65.52	7	24.14	3	10.34
SASK.	9	42.86	8	38.10	4	19.05
ABERTA	46	69.70	15	22.73	5	7.58
B.C.	50	64.10	18	23.08	10	12.82
TOTAL	310	63.39	139	28.43	40	8.18

TABLE 45

RANK OF MOST IMPORTANT FACTORS IN
CONVERTING MORE VEHICLES

	RANK 1	%	RANK 2	%	RANK 3	%
A-FUEL COSTS	215	88.84	51	13.86	4	1.87
B-GOVN'T GRANT	5	2.07	55	14.95	30	14.02
C-MAINTENANCE	7	2.89	127	34.51	56	26.17
D-ENGINE LIFE	3	1.24	60	16.30	59	27.57
E-POLLUTION	4	1.65	18	4.89	16	7.48
F-OIL IMPORTS	2	0.83	7	1.90	10	4.67
G-SAFETY	0	0.00	9	2.45	6	2.80
H-PERFORMANCE	4	1.65	29	7.88	15	7.01
I-PILFERAGE	2	0.83	12	3.26	18	8.41
TOTAL	242	100.00	368	100.00	214	100.00

TABLE 46

RANK OF MOST IMPORTANT FACTORS IN
NOT CONVERTING MORE VEHICLES

	RANK 1	%	RANK 2	%	RANK 3	%
A-FUEL COSTS	1	4.55	0	0.00	0	0.00
B-GOVN'T GRANT	11	50.00	8	27.59	4	30.77
C-MAINTENANCE	3	13.64	8	27.59	2	15.38
D-ENGINE LIFE	0	0.00	2	6.90	1	7.69
E-POLLUTION	1	4.55	1	3.45	0	0.00
F-OIL IMPORTS	3	13.64	3	10.34	1	7.69
G-SAFETY	0	0.00	0	0.00	0	0.00
H-PERFORMANCE	3	13.64	6	20.69	3	23.08
I-PILFERAGE	0	0.00	1	3.45	2	15.38
TOTAL	22	100.00	29	100.00	13	100.00

2.12 Question 12 - (Converted) - Information Sources

Table 47 presents the basic data regarding the source of information used to introduce respondents to alternate fuels and used to make their decision to convert.

In terms of first introduction, friends (24%), fuel distributors (22%) and government information (16%) are the most important source.

For their final decision, respondents indicated that fuel distributors got the first rank (31%) followed closely by friends (28%). Both the second and third rank choices were dominated by government information.

Given the fact, that respondents universally indicated that government grant programs are not an important criteria in converting, it is surprising to discover their reliance on government as an information source. While friends and distributors are the primary information sources, it is clear that government provides necessary supporting data.

As shown in Table 48, regional patterns are fairly similar except for B.C. which does not appear to have recognized the role of government as a first information source. Instead, conversion services in B.C. appear to have taken that place.

Table 49 provides a unique way of displaying the regional distribution of the rank of information sources for respondents' final decision. The table indicates (with an X) the highest score on various factors for each rank within each province. As can be seen government information scores higher more times than any other factor when analyzed by province.

2.13 Question 13 - (Converted) - Private Propane Vehicle

Of the 474 converted respondents who answered this question; 146 (30.8%) own a private vehicle which has been converted to an alternate fuel. It would appear that commercial owners are carrying the same economics into their private affairs.

Table 50 explores the hypothesis that ownership of a private propane vehicle may influence managers decisions to convert more company vehicles. The cross-tabulation of ownership against conversion, shows that there is no real difference among the group. Private propane vehicle owners are no more disposed to converting additional vehicles than non-owners.

2.14 Question 14 - (Converted) - Satisfaction

Table 51 presents the results of respondents overall satisfaction with an alternate fuel. In general it can be said that vehicle owners are satisfied. Fuel economy ranks highest among the factors, followed closely by performance. The majority of respondents give these two criteria the rank of 1.

TABLE 47

INFORMATION SOURCES - CONVERTED

	FIRST INTRO	%	RANK 1	%	RANK 2	%	RANK 3	%
MAGAZINE	101	12.14	28	7.69	38	10.86	40	15.04
RADIO	9	1.08	1	0.27	4	1.14	6	2.26
TV	18	2.16	4	1.10	8	2.29	5	1.88
NEWSPAPER	64	7.69	9	2.47	21	6.00	25	9.40
FRIENDS	202	24.28	102	28.02	50	14.29	38	14.29
DIRECT MAIL	17	2.04	3	0.82	9	2.57	7	2.63
GOVN'T INFO	132	15.87	62	17.03	85	24.29	58	21.80
FUEL DISTRIB.	180	21.63	114	31.32	71	20.29	41	15.41
CONVER.SERVICE	109	13.10	41	11.26	64	18.29	46	17.29
TOTAL	832	100.00	364	100.00	350	100.00	266	100.00

TABLE 48

FIRST INFORMATION SOURCE - CONVERTED
(THREE HIGHEST SCORES)

	QUE	ONT	MAN	SASK	ALTA	BC
MAGAZINE						
RADIO						
TV						
NEWSPAPER						
FRIENDS	27	95	14	5	32	29
DIRECT MAIL						
GOVN'T INFO	16	70	9	7	14	
FUEL DISTRIB.	22	79	9	10	27	33
CONVER.SERVICE						25

TABLE 49

RANK OF INFORMATION SOURCE

	QUE			ONT			MAN			SASK			ALTA			BC			
RANK	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	TOTAL
MAGAZINE																			
RADIO														X					1
TV																			
NEWSPAPER		X																	1
FRIENDS	X				X												T		3
DIRECT MAIL																			
GOVN'T INFO		X			X	X		X	X	T				X			T		8
FUEL DISTRIB.								X			T	X	X			X			6
CONVER.SERVICE																	X		1

X = HIGHEST SCORE

TABLE 50

RELATIONSHIP BETWEEN PROPANE OWNERSHIP
AND CONVERTING MORE VEHICLES

	CONVERT MORE VEHICLES					
OWN PROPANE VEHICLE	YES, DEFINITELY		UNDECIDED		DEFINITELY NO	
	#	%	#	%	#	%
YES	90	61.64	42	28.77	14	9.59
NO	214	65.24	89	27.13	25	7.62

People are also generally satisfied with government programs; only 11 percent gave it a rating of 5 or more. This factor did, however, receive substantially lower rating than fuel economy.

In terms of technical information, some people are satisfied, some are undecided, and some are unsatisfied. In fact, 34 percent of respondents were mildly or totally unsatisfied (i.e. scores of 5 to 7).

Tables 52 to 55 provide a regional breakdown for each of the four satisfaction criteria. While the results closely approximate overall satisfaction, the following points outline the important features:

- Quebec is not nearly as satisfied with fuel economy as the rest of the provinces. This may be due to the higher provincial taxes.

- For some inexplicable reason Saskatchewan rates vehicle performance very low.

- Ontario is by far the most pleased with government programs. B.C. and Quebec are least satisfied.

- Quebec and Saskatchewan are very unsatisfied with the amount of technical information available.

Table 56 examines the relationship between overall satisfaction and the decision to convert more vehicles. As can be seen there is general trend for those people who are generally more satisfied to answer "yes" to conversion, and those people who are less satisfied to answer "no". There are, of course, many more satisfied and many more willing to convert than the reverse.

Psychometricians have noticed that respondents will tend to be more positive or negative to a certain position because they have in the past committed themselves to that position. This bias has been termed the halo effect.[1] The argument in the case of alternate fuels would be that because respondents have already committed themselves to convert, they will not be willing to admit that they have made a bad choice and will, therefore, indicate higher satisfaction than is really true. Unfortunately, it is not possible to adequately test for the halo effect in Question 14, only to point out that it may be present.

As should be noted, however, from Table 56, the results tend to be reliable enough to predict whether or not operators are willing to convert more vehicles.

2.15 Question 11 - (Non-Converted) - Seriously Considered Converting

As shown in Table 57, 43 percent of non-converted respondents have seriously considered adopting an alternate fuel.

---

1 See Guilford, p. 279.

TABLE 51

OVERALL SATISFACTION

	1	2	3	4	5	6	7	TOTAL
FUEL ECONOMY	269	72	62	31	10	17	22	483
PERFORMANCE	252	97	66	31	14	10	11	481
GOVN'T PROGRAM	225	79	54	67	23	11	19	478
TECHNICAL INFO	111	56	77	72	38	51	73	478

PERCENT

FUEL ECONOMY	55.69	14.91	12.84	6.42	2.07	3.52	4.55	100.00
PERFORMANCE	52.39	20.17	13.72	6.44	2.91	2.08	2.29	100.00
GOVN'T PROGRAM	47.07	16.53	11.30	14.02	4.81	2.30	3.97	100.00
TECHNICAL INFO	23.22	11.72	16.11	15.06	7.95	10.67	15.27	100.00

TABLE 52

SATISFACTION - FUEL ECONOMY

PROV.	1	2	3	4	5	6	7	TOTAL
QUEBEC	29	6	7	4	0	7	10	63
ONTARIO	123	36	34	18	6	6	6	229
MAN.	18	1	6	0	2	1	0	28
SASK.	8	4	1	3	1	1	2	20
ALBERTA	47	10	3	2	1	0	2	65
B.C.	44	15	11	4	0	2	2	78

PERCENT

QUEBEC	46.03	9.52	11.11	6.35	0.00	11.11	15.87	100.00
ONTARIO	53.71	15.72	14.85	7.86	2.62	2.62	2.62	100.00
MAN.	64.29	3.57	21.43	0.00	7.14	3.57	0.00	100.00
SASK.	40.00	20.00	5.00	15.00	5.00	5.00	10.00	100.00
ALBERTA	72.31	15.38	4.62	3.08	1.54	0.00	3.08	100.00
B.C.	56.41	19.23	14.10	5.13	0.00	2.56	2.56	100.00

TABLE 53

SATISFACTION - VEHICLE PERFORMANCE

PROV.	1	2	3	4	5	6	7	TOTAL
QUEBEC	35	12	5	3	4	1	2	62
ONTARIO	121	42	33	18	7	4	4	229
MAN.	13	5	6	2	0	0	0	26
SASK.	8	5	3	2	1	1	1	21
ALBERTA	37	12	8	4	0	2	2	65
B.C.	38	21	11	2	2	2	2	78

PERCENT

QUEBEC	56.45	19.35	8.06	4.84	6.45	1.61	3.23	100.00
ONTARIO	52.84	18.34	14.41	7.86	3.06	1.75	1.75	100.00
MAN.	50.00	19.23	23.08	7.69	0.00	0.00	0.00	100.00
SASK.	36.36	22.73	13.64	9.09	4.55	4.55	4.55	100.00
ALBERTA	56.92	18.46	12.31	6.15	0.00	3.08	3.08	100.00
B.C.	48.72	26.92	14.10	2.56	2.56	2.56	2.56	100.00

TABLE 54

SATISFACTION - GOVERNMENT ASSISTED PROGRAMS

PROV.	1	2	3	4	5	6	7	TOTAL
QUEBEC	28	10	5	9	4	2	5	63
ONTARIO	118	39	27	23	11	4	6	228
MAN.	11	2	5	6	1	0	1	26
SASK.	9	2	2	6	0	1	0	20
ALBERTA	26	12	6	14	4	1	0	63
B.C.	33	12	9	9	3	3	7	76

PERCENT

QUEBEC	44.44	15.87	7.94	14.29	6.35	3.17	7.94	100.00
ONTARIO	51.75	17.11	11.84	10.09	4.82	1.75	2.63	100.00
MAN.	42.31	7.69	19.23	23.08	3.85	0.00	3.85	100.00
SASK.	45.00	10.00	10.00	30.00	0.00	5.00	0.00	100.00
ALBERTA	41.27	19.05	9.52	22.22	6.35	1.59	0.00	100.00
B.C.	46.48	16.90	12.68	12.68	4.23	4.23	9.86	100.00

TABLE 55

SATISFACTION - AVAILABLE TECHNICAL INFORMATION

PROV.	1	2	3	4	5	6	7	TOTAL
QUEBEC	13	7	5	7	8	10	13	63
ONTARIO	52	27	44	28	13	30	34	228
MAN.	5	7	4	3	4	1	4	28
SASK.	3	2	1	6	0	2	6	20
ALBERTA	19	4	13	10	6	5	6	63
B.C.	19	9	10	18	7	3	10	76

PERCENT

QUEBEC	20.63	11.11	7.94	11.11	12.70	15.87	20.63	100.00
ONTARIO	22.81	11.84	19.30	12.28	5.70	13.16	14.91	100.00
MAN.	17.86	25.00	14.29	10.71	14.29	3.57	14.29	100.00
SASK.	15.00	10.00	5.00	30.00	0.00	10.00	30.00	100.00
ALBERTA	30.16	6.35	20.63	15.87	9.52	7.94	9.52	100.00
B.C.	25.00	11.84	13.16	23.68	9.21	3.95	13.16	100.00

TABLE 56

RELATIONSHIP BETWEEN OVERALL SATISFACTION AND DECISION TO CONVERT MORE VEHICLES

	1	2	3	4	5	6	7	TOTAL
YES, DEFINITELY	63	78	97	56	14	2	0	310
UNDECIDED	16	26	39	33	15	3	0	132
DEFINITELY NO	5	7	5	10	7	4	2	40

PERCENT

YES, DEFINITELY	20.32	25.16	31.29	18.06	4.52	0.65	0.00	100.00
UNDECIDED	12.12	19.70	29.55	25.00	11.36	2.27	0.00	100.00
DEFINITELY NO	12.20	17.07	12.20	24.39	17.07	9.76	4.88	100.00

TABLE 57

CONSIDERED CONVERTING

	NUMBER	PERCENT
YES	181	42.99
NO	240	57.01
TOTAL	421	100.00

2.16 Question 12 - (Non-Converted) - Source of Information

Of those 43 percent who have seriously considered converting their vehicles, fuel distributors and friends were the most influential sources of information in their deliberations. (See Table 58) Government information and magazines tied for third place as source of data.

2.17 Question 13 - (Non-Converted) - Important Factors

Table 59 reports the scores of the first, second, and third rank of factor in deciding not to convert. The highest percentage score given any factor on rank 1 (or in fact any other rank) was conversion costs (32%), followed by not enough information (25%) and availability (18%).

Although the vast majority of respondents (including non-converted) know the propane grant program can be used to offset the cost of conversion, many must still regard it to be too small to be effective. Cost of conversion was, in fact, the most important single factor on all ranks.

When taken into association with the clear results that both converted and non-converted do not regard government programs as an important advantage, it can be concluded that the vehicle grant program at its current level of financial support may not be very effective in inducing commercial operators to convert to alternate fuels. What may be more important, however, is that the information package that accompanies the grant application may play a large role in promoting the final decision. The true effectiveness of the grant may be that it acts as an incentive for vehicle operators to acquire information and make a decision on its own merits. It appears that the economy of the fuel is the deciding factor.

The key role that information plays as a factor, is also shown in Table 59. The second highest score in rank 1 and rank 3 is given to lack of information. As will be recalled from the results on the satisfaction of converted operators, many respondents are unsatisfied with the lack of information.

Among non-converted respondents, availability of fuel at stations is also a very important negative factor. It will be remembered that both groups ranked availability as the most important disadvantage to alternate fuels. Results show that the perceived availability of propane and CNG stations are about the same for both group. In other words, there really is a perceived lack of stations.

2.18 Question 14 - (Non-Converted) - Private Propane Vehicle

As shown in Table 60, fewer than 5 percent of non-converted respondents own a private vehicle which uses propane or CNG. This is contrasted with the more than 30 percent for converted operators.

TABLE 58

SOURCES OF INFORMATION
NON-CONVERTED

	INFO SOURCE	%
MAGAZINE	30	16.22
RADIO	2	1.08
TV	3	1.62
NEWSPAPER	10	5.41
FRIENDS	37	20.00
DIRECT MAIL	7	3.78
GOVN'T INFO	30	16.22
FUEL DISTRIB.	41	22.16
CONVER.SERVICE	25	13.51
TOTAL	185	100.00

TABLE 59

FACTORS IN DECIDING NOT TO CONVERT

	RANK 1		RANK 2		RANK 3	
	NUMBER	%	NUMBER	%	NUMBER	%
A-SAFETY	3	2.04	7	2.97	5	4.85
B-PRICE ?	14	9.52	34	14.41	6	5.83
C-AVAILABILITY	26	17.69	51	21.61	17	16.50
D-RANGE	5	3.40	13	5.51	10	9.71
E-TANK SIZE	4	2.72	15	6.36	11	10.68
F-PERFORMANCE	9	6.12	12	5.08	8	7.77
G-PROV.REGS.	0	0.00	3	1.27	1	0.97
H-CONVERSION $	47	31.97	52	22.03	18	17.48
I-MECHANICS	2	1.36	24	10.17	9	8.74
J-INFORMATION	37	25.17	25	10.59	18	17.48
TOTAL	147	100.00	236	100.00	103	100.00

TABLE 60

OWN PROPANE VEHICLE

	NUMBER	PERCENT
YES	19	4.66
NO	389	95.34
TOTAL	408	100.00